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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON NUCLEAR WASTE AND MATERIALS

(ACNWM)

181st MEETING

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WEDNESDAY,

JULY 18, 2007

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VOLUME II

The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 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:

CHRISTOPHER BROWN

JOHN FLACK

ANTONIO DIAS

SHER BAHADUR

STEPHANIE BUSH-GODDARD

WILLIAM OTT

JAKE PHILLIP

SYD HACKETT

BILL BRACH

JOHN FLACK

PHIL REED

JOE GIITTER

MIKE NORATO

ALSO PRESENT:

ALBERT MACHIELS
EVERETT REDMOND II
VINCE HOLLAHAN
TONY HARFORD
ROB McCOLLUM
BRIAN GUTHERMAN
ROBERT GRUBB
COLIN BOARDMAN
ALAN DOBSON
RAY WYMER
LARRY TAVLARIDES
AMY SNYDER
ALAN HANSON
DAN STOUT
DOROTHY DAVIDSON
STEVE KRAFT

C-O-N-T-E-N-T-S

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

(8:29 a.m.)

OPENING REMARKS BY ACNW&M CHAIRMAN

CHAIR RYAN: The meeting will come to order.

This is the second day of the 181st meeting of the Advisory Committee on Nuclear Waste and Materials.

During today's meeting the committee will consider the following: annual briefing by the Offic3 of Nuclear Regulatory Research; Nuclear Energy Institute briefing on the use of burn up credit for spent fuel storage and transportation casks; transportation aging and disposal; cannister system, performance specification, rev 0, recently issued by DOE; vendors views on TAD performance specification; the ACNW&M white paper on spent nuclear fuel recycling facilities.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Chris Brown 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 that you kindly turn them off at this time.

Our cognizant member for this first session is Ruge Weiner.

Ruth.

DR. WEINER: Well, our first presentation is by the Office of Research, what they are doing on health effects and radiation protection. And it's going to be introduced by Dr. Sher Bahadur who is deputy director of the division of fuel engineering and radiological research.

And also have Dr. Stephanie Bosh-Goddar and Dr. Bill Ott.

So Sher?

ANNUAL BRIEFING BY THE OFFICE OF NUCLEAR REGULATORY RESEARCH

DR. BAHADUR: Thank you, Dr. Weiner. As you mentioned, I am Sher Bahadur, for the record. I'm the deputy director, division of fuel engineering, and radiological research, in the office of nuclear regulatory research.

In my directory we are responsible for the health effects and the radiation waste research.

The - we have come to this committee several times in the past. And what today you will see is a continuation of what we have been doing in these two areas.

As you know the agency follows very closely the radiation protection recommendations that were made by the ICRP and the United States equivalent, NCRP. We closely monitor their activities; we look at their recommendations and we review them and we make comments in case we find it necessary to do so.

This also forms the basis for interagency guidance which gets developed under the leadership of United States EPA. And we gather from the information and insights from these entities in order to make our standards for the protection against radiation under Part 20 as the committee knows.

So what you will see today is how we are developing tools and models for the licensing office, and how we are keeping abreast of all these activities in the national or international arena.

Dr. Stephanie Bush-Goddard is the branch chief for that particular branch, and she will give you a full detail of the program in that branch.

With research has evolved into a very generic radionuclide transport research for the number of years. The committee has reviewed this program when we were very intently focused on the high level waste and the low level waste. We gradually shifted our focus into decommissioning and its application in the uranium ill tailings and the groundwater contaminations.

And it's a very versatile program. It's a generic appeal, and as you see today, the way we have designed our program, it has the applicability not just to the high level and low level waste, but also other activities associated with the ongoing operating reactors and the new reactors.

Bill Ott is the branch chief for the waste research branch. And he is going to give you a full detail of the programs that we have underway.

Before I give you the feeling that things are going the way they have been going in the past in research, I would like to mention that we are right now under very tight squeeze in terms of the resources that we are competing against, a number of activities which are overtaking as for the priorities in the agency's concern.

The agency is preparing itself to look at the licenses for the new reactors. The resources are getting shifted into those from the ongoing programs. And as a result you are feeling a very tight squeeze in the decommissioning area as a result. I just mention may have to be made in the future about the program that you are going to be listening about today.

Recently my directorate also acquired a new branch, and that branch is dedicated to the updating of reg guidance. In the past you have reviewed the reg guides which were developed under a very aggressive schedule and in a very high profile way in order to facilitate the reactions for new reactors.

The committee was responsive to looking at those individual reg guides, and they are now on the book.

We are now gradually moving into phase two and phase three, where several more reg guides have to be updated because the goals and the standards have been changed; or the technical basis have to be developed; or whatever reason.

And as we enter into phase two and three we will be coming to you to find ways and means of looking at ways - taking various steps to make sure it is efficiently done. Because we are again on a very tight schedule.

Today's briefing, I have not included the reg guides developing, because that is a topic in itself, and I will come to you at some time in the future.

For today's briefing we will just concentrate on the waste research and also on the health.

So if the committee does not have any questions for me, then I will ask Dr. Stephanie Bush-Goddard for the staff.

CHAIR RYAN: Just a couple on the last point.

I'm glad you want to come back and talk to us about reg guides, because I think that there are some additional questions that we could provide to you, not now but soon before our briefing, so we could maybe ask you to better shape your presentation to those questions.

Just quickly, one is, what is the schedule and priority for probably the 100 or so reg guides that have to be evaluated and updated or not. And then second we basically pulled the string on one foundation document, the GALE code. Frankly, we're not real happy with the answer we got from the letter that came back from the EDO's office. So we want to study that question a little bit more.

Because it seems just on the face of it that issuing a reg guide and not being sure of the foundation document that is clearly supportive and transparent in its support of the reg guide is a risk from our way of thinking.

So we'd like to maybe shape a briefing, and maybe a little bit longer briefing on that topic. So I'm glad you're willing to come back.

DR. BAHADUR: Staff is well aware of the feelings the committee had on various reg guides which were done under the aggressive schedule, and more specifically the one about the GALE code where we have revised the reg guide but not the GALE code itself. And the staff is working as best as it can under the present schedule and resources.

And we would be pleased to come maybe in the next six months when we have developed material enough for the committee to review, and then go from there.

And I would like to take this opportunity to recognize the fact that when we are doing the reg guide work under the aggressive schedule, the staff came to the committee about suggestions for streamlining the process. And we received the cooperation from the committee which allowed us to publish a number of reg guides on time.

We are now developing a similar strategy for phase two and phase three, and when we are prepared to do so, then we will come and summary that for your review and comments.

CHAIR RYAN: Okay, well, we can sure talk to you a little bit more in detail about how to make that effective for you and for us.

DR. BAHADUR: Thanks.

CHAIR RYAN: Good, thank you.

DR. BAHADUR: So with that I would like Stephanie to please start her presentation.

MS. BUSH-GODDARD: Okay. I will stand up.

CHAIR RYAN: You might need to get a lapel microphone if you are going to do that.

MS. BUSH-GODDARD: Let's see.

Good morning, Chairman Ryan, and members of ACNW&M. As Dr. Bahadur said, my name is Stephanie

Bush-Goddard. I am the chief of the health effects branch in the Office of Research, and I am here today to give you our current and ongoing status of our health effects program.

Back in April of 2006 I came before you to give you a program overview. And in that overview I talked about the goals of our research plan; I talked about some of our current and ongoing initiatives. I even talked about some of the needs of the agency and what we were doing as the health effects branch to try to fill in those gaps.

And I gave a little bit about our regulatory guide project. As you know we have a lot of division eight guys that we update.

What I am going to do here is to piggyback off of that presentation but just highlight significant work that we have completed since then.

For example I am going to talk about some of our international activities; what we are doing at the research recommendation and implementation level. I'll talk about what we are doing on the domestic front. For example we have a contract with the National Academies to look at alternatives to radiation sources.

But I'll spend the bulk of my time talking about bullet three, the current radiation detection research. This is research that we request from our users' offices that include developing dose coefficients. We update, or we have our contractors to update computer codes, so I spend most of the time on that.

And then I'll hint about our upcoming radiation detection research, one being the regulatory guides. Of course we did take your advice, and we are beginning to put the contract out to update the GALE code and other codes that deal with the regulatory guide 1.109 series.

So that is kind of my agenda for today.

So international activities: we have a lot of activity in this area. For example, our senior level adviser to the health effects group is Dr. Vine Hollahan. And he is actually a member of the U.S. delegation to UNSCEAR. So he monitors that constantly.

Of course you all are very familiar about the ICRP draft recommendations, and we are monitoring the full committee recommendations.

We also support an ICRP committee member. This is Dr. Keith Eckerman. We support him through contract work to develop internal and external dose coefficients for us, and he supplies that information and gives us that information from being on ICRP.

We do a number of reviews for IAEA documents. We do transportation reviews; radiation safety reviews; and things like that.

And we also are involved in NEA. One of the things that our health effects branch does is we supply our occupational dose data to them for their database.

On the domestic front, I mentioned the National Academy. Like I said we are spending a lot of effort in contracting with them on a contract dealing with alternative sources. Now that contract or that report will come out maybe in the August to September timeframe, and we will make sure that you all have a copy of that report.

Of course, the NCRP, we spend a lot of effort in going to their activities. I think they have an annual meeting in Virginia that we attend every April. And then those are some of the domestic activities. We have a small contract CIRMS. And we participate in the ISCORS meetings.

Right now we have a draft memorandum of understanding with other agencies to try to develop a radiation protection knowledge center down on

Oakridge.

So let me spend most of my talk on our current research. Of course our bread and butter is what we call reports are the two top ones, maintaining the database of occupational exposure.

This is something that we produce annually, and we have to do the abnormal occurrence report. We are mandated by Congress to publish that every April.

What we are very excited about are the users needs that we get from other offices. For example FSMB sent user needs based on the Energy Policy Act of 2005. And here we contract out with Oakridge to do a number of things for us.

One of the projects are developing the technical basis for products containing radium 226. They were giving us different dose scenarios.

And we are also producing dose coefficients for accelerated produced materials. And I think that is like nitrogen 13, some of the very short lived radionuclides for accelerators.

Another one of our projects is developing phantoms. And I have some pictures on the next couple of slides to kind of tell you what we are doing in that arena.

And of course we are developing computer codes. One of them is VARSKIN-3 which we published this year.

So this is our current research dealing with phantom. And as you know over on your left is the ICRP phantom of 1975. It was a very crude phantom; didn't have a neck, so it didn't have a thyroid. And over the years we have been improving these phantoms to currently it has a thyroid, has a neck as you can see, the ribs are more profound and other organs, and also the legs and arms are separated.

Where now we just published a paper I think back in June where the actual phantom is articulating or moving, so now the exposure scenarios, for example, the phantom - I feel like I'm a robot -- but the phantom was straight up. But now we can actually move the phantom in different type of exposure scenarios to see if we can get a better source to set up.

So the arms and legs are separated and divided into moving parts for added moving abilities.

Now what we did with that is, we put MCNP on a GUI interface, and we have the ability to move these buttons back and forth to simulate the movement of the arms. The slider bar moves arms and legs with various geometries. And this is just an output where you can see - I know you can't read them, but these are the different coordinates, and what the neutron and the proton dose of those organs are.

The next step in doing this is, we are trying to combine what we think of as a hybrid phantom. Right now of course this is moving, but we know that the medical community can do much more accurate imaging of body parts and organs and things like that.

And we are looking at that research to see if we can combine our moving arms and legs with the state of the art medical imaging techniques. So that is the next step for that.

Another project that we are very excited about is the radiopharmaceutical project. And here we have had our contract with Oakridge National Lab to actually develop geometries for different hand source geometry setups.

And this came about because some of the radiopharmaceutical workers in industry were hitting up against the 50 REMs to the extremity limit. And we wanted to make sure that we had different types of models that modeled the hand. And ultimately this is actually in draft form, what we are doing is seeing if we could have some kind of correction factor for the ring and finger dosimeters for these radiopharmaceutical workers.

Now this was done by the contractor. But what we are also doing trying to do in house, we have MCMP that were trying to take apart and actually look at the geometry and verify these calculations, because what we want to get to is to be able to review benchmarking types of calculations for all different kinds of dose scenarios, or source geometry setups.

This is VARSKIN-3, which is a computer code that calculates doses to the skin of course. And this year we put our VARSKIN version 3, and we have added a lot of things over the years. First of all we put a GUI interface on it. We combined some of the directories. A lot of times you had to go out of VARSKIN, go to the radionuclide of concern, and then you bring it back to the programs that calculate the dose.

So we just consolidated everything and published it. Now one limitation of VARSKIN-3 is for gamma radiation it only does a point source. So we are putting out a contract next year to put different types like cylinders and line sources and things like that into VARSKIN for gamma radiation.

So that is what we have done for VARSKIN.

Now let me talk a little bit about our upcoming research that we spent a lot of time thinking about how we are going to go in the last six months.

And as you all know I came here in November of last year to talk about reg guide 1.112, and of course this is the guide, the reference to GALE code.

And we took your advice, and we are very close to awarding a contract to update the GALE code, not only update the GALE code, but also some of the code that Ladtap, GASPAR and XOQDOQ that go with the 1.109 series.

So in fact we are all - we are looking at all our regulatory guides that we need to update, 1.109 series, and most of the division eight, to see what computer codes they reference; to see what new words, what documents they reference; what ANSII standards; to make sure that we look at those, and those are current, before we go into updating the actual regulatory guide.

Therefore some of the guides that we might have done for phase two that might have to be done this year or next year will actually be put off until the technical basis is developed.

So as Sher said, we will definitely be coming to you in the next six months to give you updates on that.

Talking about the regulatory project, one thing that we are very troubled about is giving assistance to the state of the art reactive consequence analysis project.

The assistance that we give in the health effects branch, giving advice on LNT versus linear threshold theories, and we also are helping them develop some internal and external dose coefficients to put into the code they are using for consequences which is called MACCS.

And of course we are continuing the NCMP modeling. We are very excited about that to kind of do some future benchmarking, with the hand phantom and the whole body phantom for certain scenarios.

And finally, this is hot off the press, this is from a product that we are doing that we got a user's need request from NRO from NRR, even from the regions, to update the study that was published in 1990 that looked at cancer and populations around nuclear facilities.

Now it was published in 1990 as I said.

They used cancer mortality data. And now people are more interested in the incidence of cancer, you know, will I get cancer as opposed to will I die from cancer, but they are interested in that too.

So the upcoming study looks at cancer mortality and incidence. In the 1990 study they used counties, but now we are going to try to explore smaller geographical areas, maybe by zip codes, maybe by looking at people that lived - that worked in the nuclear power plant, and where they actually live.

And the reason we are troubled about this, the study was published in 1990, but they stopped using cancer data from 1984. So we have more than 20 plus years of new cancer mortality incident data to put in this updated study. And we are contracting with the National Cancer Institute to do this, because they did the last one.

So in a nutshell that is kind of a quick overview of significant work. We are a very small branch, as I said. We have maybe about six or seven people, but we are very passionate and excited about our work. And we have a lot of work to do.

DR. WEINER: Stephanie, I'm going to break here for questions, and the chairman has questions, many questions.

CHAIR RYAN: If I could start, if you'd back up on that slide there for a minute it would be great.

I see a logical inconsistency here, and I just want to ask you about it.

MS. BUSH-GODDARD:

CHAIR RYAN: How can you update your reactor consequence and cancer incidence calculations if you still don't have the basic updated.

MS. BUSH-GODDARD: Well, what we are doing is, we are supplying for example dose coefficients for certain radionuclides. We are updating the dose coefficients. We are not doing necessarily the complete calculation from PRA 1, 2 and 3. We are just doing parts of that to get ready for when they finally do the PRA 1, 2 and 3, we will be ready with updated - it's kind of like we are doing the technical basis work.

CHAIR RYAN: Let me sharpen my question a little bit.

MS. BUSH-GODDARD: Okay.

CHAIR RYAN: I think I have questioned - and always have and probably always will - question cancer incidence calculations from releases throughout these small areas and small populations.

MS. BUSH-GODDARD: Okay, we're on this cancer study.

CHAIR RYAN: No, we're not. We calculate cancer deaths, cancer incidence rates as part of the required calculations. I question that; I don't think it's technically sound. But I do applaud the idea that you are going back and looking at the incidence data and updating the database.

So you don't see a relationship here, then, is that what --

MS. BUSH-GODDARD: Oh, okay, yes. Actually the SOARCA project and the cancer project are two different projects that we are doing, so they are separated.

I think what you are talking about in the SOARCA project, how we are calculating cancer deaths, that is something that needs to be looked at.

CHAIR RYAN: It's wild. It doesn't make any technical sense to me.

MS. BUSH-GODDARD: I hear you loud and clear. And luckily, they are not at the point where - we are at the point now, having your opinion on that would lead us --

CHAIR RYAN: Well, it's all about dose and dose rate. It's the same as saying that one mile an hour wind for 200 hours has the same effect as a 200 mile an hour wind for one hour. The same amount of air goes past your head, and you are equating them as equal. I challenge that.

DR. BAHADUR: Excuse me -

CHAIR RYAN: I'm not done. A couple of other quick questions.

DR. BAHADUR: Excuse me, I have Dr. Vince -

CHAIR RYAN: Well -

DR. BAHADUR: - to answer the question you just now posed.

MR. HOLLAHAN: Regarding SOARCA -

DR. WEINER: Vince, would you tell your name for the reporter.

MR. HOLLAHAN: Dr. Vince Hollahan with the Office of Nuclear Regulatory Research.

One of the comments on the SOARCA project is, we have a commission paper that is being developed to look at the health effect endpoint.

With that in mind we are going to provide several options for the commission. One option would be to retain LNT; that would be consistent with the Sandia siting study.

A second option was to look at a number of different thresholds from zero up to let's say 50 or even 100 millisievert.

And a third option is to say, look at a single endpoint, which would be a 50 millisievert threshold that would be consistent with the Health Physics Society position paper. And then only look at exposures above that number.

The paper is being prepared now. It should be going up to the commission in the next weeks or a month or so, and we are going to get some guidance back from the commission, because this is basically viewed as a policy decision.

CHAIR RYAN: Maybe when that comes up you can come and tell us in some more detail.

That sounds great. That sounds like it's on the right track. Thank you for that clarification; appreciate it.

Real quickly, you didn't follow our advice on the GALE code. We said update it before you issue the reg guide, and you issued the reg guide, and now you're updating the GALE code.

So it's good you're updating it, but it wasn't what we recommended. Just so we clarify.

MS. BUSH-GODDARD: Duly noted.

CHAIR RYAN: The second is, on your general comments on reg guides which, I think it's great, you are looking at the situation systematically, did I understand you, you mentioned a couple of consensus standards. I think you said ANCI or ASME or one of those.

Is your idea to maybe look at and use consensus standards, or adopt them, or integrate them, or endorse them as you can?

DR. BAHADUR: Dr. Ryan, as you are aware, the agency develops reg guides in a number of ways, one of which is to endorse the consensus standards of the industry. It's a practice we have followed in the past.

What has happened at times, our reg guide has been put in place while the consensus standards have taken their own speed and gone ahead of us.

So we are now looking back at our reg guide to see if the time has come to endorse. Sometimes we endorse wholeheartedly; sometimes we do with exceptions. And that's the way we have been doing in the past, and we continue to follow that.

CHAIR RYAN: And one last question on the reg guides, we know have a system of dose calculations that ranges from guidance from 1959 to let's say near the present.

Is there any plan to look at how we do this in a consistent and fairly uniform way?

DR. BAHADUR: Right now the plan is to look at each reg guide on a case by case basis and see how consistent we can make it to the present state of art.

CHAIR RYAN: And I know you are stuck sometimes with the regulation itself is based on all old dosimetry system 61, 10 CAR Part 61 and so forth. But that seems to be something that is getting to be a more complex problem, rather than getting clearer.

So I'd be curious, maybe not today, but sometime to hear your more detailed thoughts on where the pitfalls are of that complex system, and how it might get straightened out.

I know that's a huge job, so I'm asking a big question, I realize.

DR. BAHADUR: Well, that is your 10 miles an hour wind coming 200 days in a row.

CHAIR RYAN: That's right. Thank you.

DR. WEINER: Jim?

DR. CLARKE:

DR. WEINER: Allen?

VICE CHAIR CROFF: No.

DR. WEINER: Bill?

DR. HINZE: A brief question on this cancer and population around nuclear facilities. I assume that you are going to be looking at other demographic variables other than smaller geographic units?

MS. BUSH-GODDARD: Oh yes, across age --

DR. HINZE: Soil type that they live on, et cetera?

MS. BUSH-GODDARD: Let me hold off on that question. Like I said, this was hot off the press in that we just received a request from the office to do that.

But let me go to Dr. Hollahan, because he was privy to the previous studies. He's kind of been working -- can you add to that?

MR. HOLLAHAN: Again, Vince Hollahan from research. We are going to do something that is very similar to the 1990 study, and that is, looking at small population groups that are around reactors.

But you have to find a comparison group. And what's very difficult there is, it's basic socioeconomic data that we're looking at. If it is a small population group, rural type of group, we are finding counties or areas like that that have similar demographics, similar socioeconomic status, and trying to then do a one to one comparison.

It's very much an ecological type study.

Again keep in mind we can't use necessarily the same counties that were used in 1990 because of population growth.

So the biggest challenge is going to be to find population groups to look at.

As Stephanie mentioned, the big thing that is going to be here is, we're going to have a chance to look at over 100 reactors as opposed to about 60 that we had previous to this, and the fact that now we've had some follow up time.

When the study was originally done, we said that we were looking at cancer mortality in the 1984 time frame. We are talking about very short latency period times.

Now we've got basically another 17 years of data. Do we expect to find anything? Quite frankly, no, but if we do, and if there is a statistical possibility that something could come up, then that would have to be explored in greater detail.

Again, we'll be looking at male, female, ages from pediatric all the way up to geriatric, keeping in mind much of the impetus back in the 1980s was TAI, and what is the impact of childhood leukemia.

So those were obviously the drivers at that time, and again, we will be looking at that in this future study.

MR. MOORE: Thank you very much. That's helpful.

DR. WEINER: Just to follow up on that question, how are you -- in the study, how are you correcting for two factors, one of which is smoking, and the other one is the movement of populations? Because on the average people in the U.S. move every three years, so they haven't lived there that long.

Is there a protocol that you have for taking those into account?

MR. HOLLAHAN: At this point I would say smoking probably will be controlled, because that is fairly easy to do with surveys.

We will have to talk to the folks at NCI to see how they deal with the population migration. At this point I don't know how that one is dealt with.

DR. WEINER: There is an algorithm that the Bureau of the Census puts out that you might look at for population movements.

I had another really brief question for Stephanie. You mentioned alternative sources. What are those?

MS. BUSH-GODDARD: Okay. Actually, the project manager is here.

Mr. Harford, can you give maybe a two-minute spiel about the copy of the report that they will be getting?

MR. HARFORD: Yes, Stephanie.

Tony Harford, USNR Office of Research. I'm a project manager for the National Academy's radiation use and replacement study.

This is a study that is required by the Energy Policy Act of 2005, and it directed the NRC to look at high activity sources. These are IAEA category one and two sources that are used in like bitter radiators, large sterilization facilities, radiography cameras, et cetera.

What the National Academy is doing is seeing if there is a technological alternative to these applications. For example can you use radar, microwave, ultrasound, X-ray generating equipment, small accelerators, in a variety of applications, to see if these sources can be basically replaced.

And we've been working with the National Academy since January, 2006. They put the report out for peer review in June of this year. We are meeting with them actually this Friday to talk about the results of their peer review, and hopefully getting this report to us in the next several weeks.

The deadline for submitting this to Congress was August, 2007. But we are experiencing a study delay with the National Academies, and we are hoping that the study delay will be only about one month.

DR. WEINER: Thank you for the clarification. That sounds like a very interesting study that we may want to hear some more about.

MR. HARFORD: Well, we are planning on giving you a copy of the report when it comes in.

DR. WEINER: Thank you.

If no one has any further questions, Bill Ott, you are next.

MR. OTT: I'd like to thank Sher for giving sort of a global history. The program goes back a long way.

In recent years it has been primarily focused on supporting the decommissioning program. We have come before you a number of times to give detailed briefings. We don't really have time for that today.

In the last I guess three years we have given you fairly detailed briefings on things like treatment of uncertainty, model abstraction, thermodynamics option modeling, engineered barriers, cooperative effort with other agencies.

We've had a number of extensive briefings of your staff, and we have also supported you in a number of your workshops. So I think you are fairly familiar with the detail and the quality of our researchers.

So I'm going to primarily discuss basically what our status is in terms of products that we have come out with in the past year, and where things appear to be going for us.

I've organized the briefing, discuss progress first, primarily organized around the general program areas we work in based on what you do a performance assessment for and the environmental transport problem.

Plans for transition, because as you will see, because of the resource problems, we are faced with a transition.

And my last slide is going to talk about some unresolved issues that we haven't even looked at yet.

We always sort of - we always try and progress the way a PA calculating starting with the source term. The only source term work that we have had going on in the last couple of years is the work on SADA, which is basically a tool for doing a better and more efficient job of determining what your source term is.

And the early versions of SADA were primarily focused on surface contamination, looking at trying to design efficient sampling systems.

The current effort is on volumetric sampling. And I am trying to accurate determine the geometric distribution of contaminants in soils.

SADA Version 5 is the first actual public version of this that we released. It was planned to be released in August, but they have had problems with the time of the calculation. And they have gone back to the drawing boards trying to speed up what they have got. And we are actually not going to get it out until November.

We have a training course scheduled to be conducted at the same time as the release. There will be a code and a manual for staff use, and there will be a test period to follow that.

We talk about engineered barriers, because that is one of the first ways of trying to contain that source term. The engineered barriers is one of the areas where we actually proceeded without a user need.

DR. BAHADUR: Excuse me, do you want to change the slide?

MR. OTT: Oh, okay, sorry.

DR. BAHADUR: Thanks.

MR. OTT: This was actually more innovative research that was brought up by our staff, because we became aware of a number of situations where engineered barriers were not performing as designed. So we began work on concrete barriers with NIST. We began work with clay barriers, clay barriers with the Corps of Engineers.

We cooperated in the initiation of a study by the National Academy on assessment of the performance of engineered barriers. That study was recently completed. The draft report is available on the National Academy's website.

The formal final report isn't yet available, at least it wasn't a couple of weeks ago which is the last time I actually looked for the final report - for the actual published copy.

That was a fairly comprehensive review of the state of the art with regard to engineered barrier performance.

We published -- or not published, we compiled a research information letter on the concrete performance work earlier this year, and transmitted it down to FSMB to summarize all the work that was done at NIST.

The clay barrier study we expect to complete this year with FY `07 funding. We have a USES/University of Wisconsin study on exhumed covers that we are doing in cooperation with EPA.

We also expect that to be completed, although we don't quite have the funds to do that yet.

In groundwater monitoring and modeling, you have all seen Tom's programs - oops, sorry about that. You have had multiple briefings from Tom, and the work that has been done with P&L on uncertainty. The work with ES and monitoring, and the work in the Agricultural Research Service in which we are cooperating in getting a large degree of leverage with regard to the application of our resources.

With regard to the monitoring and modeling work, we have done two training courses. Monitoring has become a very current topic with our regions because of issues that have hit the press in terms of groundwater contamination and the number of nuclear power plant sites.

So we are trying to help both the regions and NRR come up to speed with regard to the current state of the art on monitoring and design of monitoring programs.

And we have got another training course planned for this August, August 23rd and 24th.

Final report on this project on an integrated strategy for groundwater monitoring and modeling is expected in October of this year.

We have completed work on combining conceptual model, parameter, and scenario uncertainty. This is the work that was done at PNNL.

We have conducted three training courses on the application of this information, and the final report has been submitted and is currently under review. In fact it should be published either at the end of this month or the end of next month.

And we also published this year NUREG/CR-6884 on model abstraction techniques, which came out of the ARS program. Those abstraction techniques are currently being tested at Beltsville at their watershed modeling project, and we just held a two-part training course with regard to this work in which there was -

DR. BAHADUR: Excuse me, the slide, please.

MR. OTT: Sorry.

The two-part training course involved a

theoretical portion and then a visit out to the field to examine the work that was being done at the Beltsville Research Center.

About a year and a half ago we brought before you our geochemistry program, which was primarily work on transport. We probably had a full three hour briefing for you on the work that we had completed at Sandia National Laboratory, and the work that was still ongoing at the USES.

There was a parallel effort ongoing at the time with the NEA absorption program. The NEA sorption project did end about a year ago with the publication of a final report.

We also had efforts underway on this program with ISMEM in terms of a major workshop that was held out at Albuquerque.

The conclusions of both the NEA sorption project and the Albuquerque work were that the intensive work that has been done, not just by the NRC but by a number of countries over the year on sorption has led us to a point where it is possible to apply thermodynamic sorption models in performance assessment.

The traditional approach has been to use a constant kV, which everybody knows is wrong. Using thermodynamic sorption models will allow us to consider they complexity involved - the varying chemical conditions - and produce something that varies as a function of time, chemical composition, and location.

The thing that is needed, however, since this is a very complex technology and guidance on how and when to apply these techniques. That was one of the recommendations that came out of both the workshops. The NEA has come to us with a proposal for a phase three which would focus on developing a guidance document for the applications in thermodynamic sorption models. We hope to be able to participate in that.

We did plan to participate in the planning meeting for it.

The USES project as a matter of fact ends in January. So the final report for that would be coming to us probably in November, and we will have to have a little time to make changes and respond to it.

In terms of performance assessment models we focused in two areas, two primary vehicles, RESRAD-OFFSITE and FRAMES. RESRAD-OFFSITE is an extension of the RESRAD family of codes. It would still be applied in most cases to relatively simple sites.

FRAMES is the vehicle that we would use for addressing more complex problems.

FRAMES2 would be advanced linkage to GMS. It's supposed to be provided in September. The RESRAD-OFFSITE code and manual are in their final DOE review.

They have had a reoroganization at DOE, and are delaying the publication of the code and the report.

We did hold training on this version of the code back in March.

In terms of the biosphere pathways work, I believe you saw this again about 18 months ago in this summer, 12 to 18 months ago.

The final report on that is actually under review by the project manager, Phil Reed, right now. And should be issued probably at an August date when it's actually published.

We also published 6881, soil and groundwater sample characterization, agricultural practices in August of 2005 in Alternative Conceptual Models for Food Chain Pathways in June of 2006.

As Sue mentioned earlier, we have had a lot of - there have been a lot of things happening to the commission over the past couple of years. The earlier - the public awareness of a number of contamination situations at nuclear power plants is one of them, and there was a lessons learned task force convened. We participated very heavily in that in terms of giving our groundwater modeling expertise, modeling and monitoring expertise, to help come up with it. It's more familiarly known as the tritium task force.

We provided support to the NRC regions for many of the individual cases in which contamination had occurred. We've provided extensive support to FSME on the use of bioremediation at the Cimarron site.

We produced regulatory guide 4.15 which you reviewed for us on Q/A and Q/C regarding environmental measurements. And we actually have a training course for regulatory guide 4.15 schedule in August.

One of the complaints that came from the industry was that they had little familiarity with the use of MARLAP or the techniques that were being referenced in 4.15.

And that carries over to a large extent to our own regulatory staff. So we saw a need to develop the training, and were providing that in August primarily for NRC staff, then we are going to follow that with a public workshop to expose the same material to the industry.

So we are going out of the way to try to provide guidance before it needs to be provided.

And of course we produced draft guide 4012 which you reviewed last month and provided a letter on.

We are trying to deal with some of the comments from your letter, some of your recommendations, prior to issuance. We will probably, as with the GALE code, come short of your expectations. But we hope to come far enough to be helpful to the nonreactor licenses.

I think that is a good way of saying that.

Plans. Currently, we don't have any resources in decommissioning. We don't have any `08 resources in decommissioning. We have not FTEs and we have no dollars.

We have some resources under reactors, and we have some resources available to us for additional development of regulatory guides.

We actually have at least four regulatory guides, or more regulatory guides which are scheduled to be produced over the next year. A couple of them are in the category that Stephanie mentioned where we think the technical basis needs to be developed before we step into actually putting out guidances.

There is a considerable amount of work in the decommissioning area that will be completed with carry over funding in FY `08. In other words we generally plan for funding to extend a couple of months into the next fiscal year for matters of continuity, because it takes awhile for budgets to be approved and for money to be allocated and that kind of thing.

In this particular case we are coming off a year where we actually didn't have a budget for almost six months. So there has been a lot of confusion. A lot of late starts on projects and things like that.

Currently most of the programs that we are talking about will be completed probably by the end of January.

There are some details here on exactly how this situation came about. There is an OMB cut to our `08 budget proposal and administrative considerations which resulted in the research portion of the program being terminated.

Some of this work will continue under the new reactors area.

If we look specifically at the projects that we have just discussed, particularly ones that have not - I'll try to discuss some that we won't even come close to completing.

RESRAD-OFFSITE, we have accomplished probably half of the skilled -

DR. BAHADUR: You've changed your slide.

MR. OTT: All right.

RESRAD-OFFSITE we have completed about half the work on the SOW. There is another 50 percent yet to do.

We actually completed the work we were doing on training NRC staff use of the Corp of Engineers groundwater modeling system, which is a very powerful tool for looking at groundwater systems.

The assessment of the nonconcrete barriers we will try to complete with FY `07 funds.

The database to support sorption modeling will be completed, again, by January.

The study of exhumed covers, we provided most of the money to complete that with FY `07 funds. We are a little short.

That being a place where we have got leveraged resources, and they are looking at actual performance of barriers, we would like to try and complete that.

Orderly closeout, the radionuclides pathways that we reported to you, the focus on that has been on radionuclides that are of interest to FSME. And we have a user need from NRO. Stephanie alluded to it briefly, which talks about the codes that are used to calculate doses, LADTAP and GASPAR.

And the GALE code is listed in that same use. But it terms out that one of the things that NRC was asked for is updated information on plant to animal - soil to plant transfer factors and plant to animal transfer factors.

So if this work continues, I think it will have to be refocused to deal with the user need from NRO.

SADA is applicable to any situation with groundwater contamination. We would hope to be able to fund a mechanism to continue the SADA work.

FRAME software is also a powerful tool that can be used to address contamination in a situation. We would hope to be able to be focused on that work to be of use in other parts of the program.

The model abstraction techniques, currently I guess we will try and find an application for this. Process of determining the proper level at which to model a system is extremely important across the board. So hopefully we will be able to justify continuation of that work.

I call these orderly closeouts because if we can't do that then we will just find a way to get as much product as we can out of these projects and then terminate them.

The field studies of the watershed flow at Beltsville, this is part of the model abstraction work in terms of demonstration of that technology right now, so if we manage to continue that, we will probably try and do it through the work at the field study.

And we will try if possible to continue our support for the National Academy. We give them a small grant every year - I won't say how much - but it gives us access to experts and opinions and review of our programs that we consider to be far more valuable than the minor amount of resources that we put into it.

Unresolved issues: we actually don't have the source of funding for the sorption project closeout yet. The development of the practical application instructions, the guidance for using thermodynamic sorption models.

NEA is proposing to do it. We had FY `07 funds. But the formal proposals didn't get to us soon enough to use that. So we are going to be in the FY `08 area, and we are going to have to seek justification for actually completing this with other funds.

One area that is recently come - been revealed to us is the existence of a concrete performance code called STADIUM. STADIUM is actually a commercial code that is based on the work that we did at NIST in producing FORSITE. But whereas FORSITE is primarily a research code and doesn't have a fancy user interface and all sorts of bells and whistles on it, the STADIUM code does.

And it does an awful lot of things. They have incorporated information beyond STADIUM to the point where this code will probably be of use both for FSME in terms of things like the WIR project, and for new reactors in terms of performance based formulations for concretes for various purposes used within the reactor facility.

So we are pursuing the possibility of funding some work on STADIUM, enhancing it, both for FSME and for NRO.

Groundwater mediation is a topic that is becoming more and more important. We would - we'd consider that to be an unresolved issue.

There has been a certain amount of work done by DOE. We are planning on doing a small amount of work with FY `07 funds, to try and get farther into the details of what DOE has accomplished, and maybe look at some of their specific sites that they have examined.

But again are resources are limited to get much accomplished on that. We think that that is an area that is going to be important for a number of years.

I mentioned that we have at least four reg guides. I think there are also some phase three reg guides that we have that we are supposed to have accomplished. I couldn't tell you in detail what they are right now. This number of eight is approximate.

I think that's it.

DR. WEINER: Well, thank you very much. We are going to run a little overtime, so I'd ask the members to limit themselves to one question if possible, and start with Jim.

DR. CLARKE: Thanks, Ruth.

Bill, could you pull up slide four.

MR. OTT: Slide four? All right.

DR. CLARKE: The engineered barriers research. I've got a number of questions about this, and I want to honor this request. So maybe you could just put me in touch with some folks, and I can get it offline.

But the engineered barrier performance, Army Corps dessication and cracking, I assume these are clay barriers without the accompanying geomembrane.

Are these - are they actually looking at barriers that are in use? Or are they doing laboratory studies? Or what is that all about?

MR. OTT: I'll let Jack Philip answer that question.

MR. PHILIP: Jake Philip, I'm with the office of research.

To answer your question, Jim, when we first started this contract, we were concerned about very rapid dessication of clay barriers in many of the sites. And so we asked the U.S. Army Corps of Engineers to look at that phenomenon.

They produced - they had a report which gave us an indication of the extensive barrier - clay barrier cracking. They did not consider geomembranes at the time.

We just looked at clay barrier performance because there were some sites with clays as the barrier, so we wanted to know how these could be - incorporate their - how clay barriers crack. Why do they crack? It is mostly due to vertical transport of moisture, so we are trying to estimate the extent of the cracking and trying to model it somehow.

So we have reached a stage where we have done some experiments, looked at the cracking of clays, and have incorporated it in a model that the Corps of Engineers are developing.

CHAIR RYAN: And I would assume that if you put a geomembrane over the clay that that would -- I'm just wondering if you are looking at that too.

I'm sorry, I just asked Drake if they had done any studies with geomembranes covering the clay.

MR. PHILIP: We haven't looked -- we haven't considered geomembranes in this research project because we did not have this item in the project when we started that project.

But we do know that geomembranes is an important issue. There have been some problems with geomembranes, particularly with respect to its placement and the cracking of geomembranes due to placement and due to the waves forming in that. And also some due to isomorphic substitution where you have the sodium being replaced by calcium in groundwaters.

So those are issues that we are looking at, bu9t the National Academy study did go into that particular issue on geomembranes. But we do not have much field actual observations in the field about those things. So some of the things they have said in that report, actually, that report is to have more monitoring of those different components of the barriers.

DR. CLARKE: Bill, in the interests of time, maybe I can follow up with Jake. And let me yield.

DR. WEINER: Thanks.

CHAIR RYAN: I don't have any additional questions. And I want to apologize. I have to go to another meeting, and I will turn over the gavel to Vice Chairman Croff.

DR. WEINER: Thank you.

Allen.

VICE CHAIR CROFF: As long as we are on this slide, you have listed a number of studies and efforts related to engineering barriers here. This committee has also - we've had a couple fo workshops that you have attended and participated in. And so we are getting a fairly significant pile of information.

How and when is all of this going to be brought together to figure out what do we make of this, and what do we need to do in terms of regulation and guidance or whatever else? It seems like the pile is getting big enough that maybe we are at that point?

MR. OTT: I would recommend the National Academy study that Jake just mentioned. That's a much more - it's a very extensive study and has a number of conclusions in there with regard to the state of our knowledge of the various systems.

And correct me if I'm wrong about this, Jake, one of the conclusions was that a lot of these systems seemed to be working as designed. However, there is almost no long term data to say how these things will work in the long run. And the National Academy's committee essentially recommended a monitoring routine as being something that is associated with any of these barriers.

With regard to whether there is more work to be done, the actual Corps of Engineers project that was started, the original SOW actually was more aggressive, and we determined when we started out that we knew a lot less than we thought we did. So we actually had to play catch up in terms of actually understanding the performance of clay barriers from the very beginning.

We worked a lot longer on the concrete problem, because we were at one time working on a user need with regard to entombment. So we have a fairly good idea of - and model for using concrete, and this STADIUM code with minor enhancement may be the current state of the art answer to most of our problems.

VICE CHAIR CROFF: What I'm getting to is, where does all this get reflected in regulation or in guidance? Or in standard review plans? Or something that - I mean I assume the goal is to use it.

MR. OTT: The standard review plans are generally developed by the licensing officer. So we have provided a real -- to the user office, and in this case it was NMSS back when we still had NMSS and FSMB as a single office.

And a lot of the information on engineering barriers has been incorporated into NUREG-1757, the last revision of that had a fairly significant entry in the information on how you would consider engineered barriers for use in decommissioning.

Do you want to add something, Jake?

MR. PHILIP: Yes, I just wanted to add on that, we -- Jake Philip, with the Office of -- we did give -- we did help the Office of FSMB at the time and NMSS on the decommissioning guide. So we put a lot of our information that we had already gained into the guide. The guide was then reviewed by the public. It was sent out for comments, and then came back with comments. And then we addressed those comments and increased the amount of stuff that we put on engineered barriers to quite an extensive amount.

VICE CHAIR CROFF: Okay, thanks.

Bill?

I only had one question which relates to your close out slides. When you close out - you don't have to go there - when you close out a program or a model what happens to the model then? Because computer technology moves right along. So does modeling technology. And what do you do? How do you handle it with SADA and FRAMEs and so on?

MR. OTT: Well, we're fortunate in that both SADA and FRAMES -- well, SADA, FRAMES and RESRAD are all supported by multiple agencies. What happens is that we lose the flexibility of focusing these particular codes on NRC concerns.

They will continue to evolve under these other agencies' auspices. We will continue - they will probably continue to maintain the versions that we have provided. But in the long run you lose control, and you lose that ability to address issues that come up.

For instance, if you go back to the sorption work, we have worked on that problem for probably 15 years. And that's not just us. It's the DOE, it's the Environmental Protection Agency, probably a dozen countries around the world that have been trying to deal with this problem.

And the problem originally arose because computation systems could not handle the complexity of the problem.

So we have made a significant accomplishment to get to the point where we are now, where we can use thermodynamic sorption models. And it's an accomplishment that all of my staff I think would feel proud of.

But there are other chemical issues out there that aren't adequately treated in the models. We thought sorption was the most significant and the most important one.

So if we don't continue to do the work on the codes we are not going to be able to address those issues.

DR. WEINER: Thank you very much. And in the interests of time, I just wanted to thank you for an excellent overview and presentation. And we will move to the next speaker, which is from NEI, who is going to give us a briefing on the use of burn up credit, and the speaker is Everett Redmond, who is here I hope.

Everett is the senior project manager with NEI, and is responsible for issues relating to used fuel transportation and storage.

And I'll skip the rest of the bio. And you are also going to - we are also going to hear from Albert Machiels from EPRI on this same issue.

So go ahead, Everett.

NUCLEAR ENERGY INSTITUTION (NEI) BRIEFING ON THE USE OF BURNUP CREDIT FOR SPENT FUEL STORAGE AND TRANSPORTATION CASKS

MR. REDMOND: Well, thank you very much. I appreciate the opportunity to speak with the committee here on burnup credit.

We hope that the information that we are going to provide today broadens the committee's understanding of the underlying issues associated with criticality, safety and transportation.

Burnup credit, moderator exclusion and high burnup fuel are all linked to some degree. The committee has heard presentations previously on moderator exclusion, and high burnup fuel, from the staff and expert presentations from us in regards to moderator exclusion.

Now we are going to take an opportunity to talk about burnup credit.

Burnup credit is taking credit for the depletion of the fissile materials and the buildup of poisons in the fuel assembly that occurs during a radiation reactor. As was mentioned yesterday at the committee meeting, during the NMSS briefing, burnup credit is related to high burnup fuel through the analysis of the reconfiguration of high burnup fuel.

Therefore the ability to transport high burnup fuel depends to some degree on the ability to take credit for burnup of the fuel assemblies. And we hope that the information that we provide today will assist the committee in some of its recommendations.

Currently, use fuel without burnup restrictions is being loaded for storage in dual-use canisters, and the acceptability of the contents of these canisters for transportation is uncertain, especially for higher enrichment and higher burnup fuels.

There are several approaches that are being considered for effectively resolving the issue: risk informing regulations and regulatory practices; moderator exclusion which we have heard about before, which is basically ruling out a criticality event as an issue, except of course for loading and unloading which occurs in a spent fuel pool; and also burnup credit.

Now in this case enhanced Part 71 burnup credit or moderator exclusion would certainly provide the assurance that we need to be able to transport these loaded DPCs.

In regards to risk informing, yesterday Bill Brach of the FSS team mentioned that the staff is moving ahead on risk informing the standard review plan for storage. We certainly applaud this effort, and look forward to taking a look at the standard review plan when it's complete.

The ACMW also mentioned in their letter to the commission in regards to moderator exclusion that risk informing and transportation could be of benefit.

We also encourage the staff to do this, and we at NEI have taken an action item to come up with a proposal in this regard as well which will be presented to the staff at some point in the future.

A little bit of background. The NRC sought ACNW feedback regarding their plan on moderator exclusion in February/March. In March we also provided input and suggested that the discussion be expanded to cover burnup credit, which is why we are here today.

The presentation today will focus on burnup credit and burnup measurements, and if possible relationship to moderator exclusion.

Now let me take a second and talk about burnup measurements, which Albert from EPRI will predominantly speak on.

Burnup measurements is the physical measurement of the burnup of a fuel assembly prior to loading. So you would take use monitors or detection devices to measure the burnup of a fuel assembly while it's in the spent fuel pool.

NRC interim staff guidance eight, revision two, requires that this be done to, quote confirm the reactive record of each assembly.

Now Albert is going to speak on, the reactor records are based on measurements, so we believe we already have accurate measurements of the burnup of the fuel assemblies. And then extra measurements are not necessary. Albert, as I said, is going to expand upon that.

A little bit on regulatory background. NRC regulations and review guidance for criticality differ between wet storage which is Part 50; dry storage which is Part 72; and transportation which is Part 71.

In Part 50 burnup credit including full fission product credit can be taken. Now for normal conditions in Part 50 if you are not taking any credit for soluble boron came roughly less than .95. You are permitted to take partial credit for soluble boron in Part 50 for normal conditions, which typically means about 300 parts per million.

And there k-effective also must be less than .95.

Now if you have done that, then in Part 50 one of the accidents in there you need to look at is complete loss of soluble boron, which k then is left in 1.0. The administrative margin is not there.

In Part 72 fresh fuel must be assumed, and you take full soluble boron credit, typically greater than 2000 CPM for fuel assemblies of 4 percent enrichment; and again, k less than .95.

In Part 71 there is some burnup credit permitted, actinide only currently, per the ISG, and k-effective is less than .95 without soluble boron.

Of course in transportation there is no soluble boron present, because you are on the open road, and if any accident were to occur, it wouldn't be in a borated pool.

Part 50 regulations, just to reiterate what I've just mentioned. 50.68(b)(4) says if no credit for soluble boron is taken, the k-effect must not exceed .95 if blitted with unborated water.

If credit is taken for soluble boron, the k-effective must not exceed .95. If flooded with borated water, and the k-effective must remain below 1.0, subcritical, if flooded with unborated water.

Now I would note here that the complete loss of soluble boron in a spent fuel pool is an extremely unlikely scenario, and as a result they have provided a little more margin here; in a sense not margin, but they have provided a little more ability to analyze closer to 1.0. In other words, just barely below critical. So the administrative margin is not pleasant in this case. It's something I'm going to touch back on a little bit later in the presentation.

Now in Part 71, 71.55(b) says, a package must be so designed and constructed, and its contents so limited that it would be subcritical if water were to leak into the containment system, so that under the following conditions, maximum reactivity of fissile material would be obtained.

The most reactive credible configuration and moderation by water to the most reactive credible extent.

This means that freshwater has to be put in the cask, and to analyze any different density of the water to make sure that you put the most reactive credible configuration.

Now this is where moderator exclusion would come in and would basically say that water never gets inside either the containment system or the inner cannister in some cases. And in some transportation capsule containment system is a cask itself, and the inner cannister, the DPC, the dual-purpose cannister, is seal welded but is not defined as a containment system.

So moderator exclusion could say that water doesn't get inside the DPC, and therefore there is no criticality event. That is something that we discussed back in March.

Now I am going to take an opportunity to talk a little bit about the similarities and differences between Part 50, Part 71, and Part 72, to highlight some of the characteristics associated with burnup credit in Part 71 and in Part 50.

In Part 72 there isn't burnup credit currently. It is all fresh seal with soluble boron, but I will get back to that as well.

The computer codes must be benchmarked against critical experiments. The same process is done in Part 50, Part 71, and Part 72. Fuel characteristics are considered in all three the same. Variations in enrichment, physical characteristics, and the fuel assemblies.

Peak moderator temperature must be considered. That may be a different peak moderator temperature depending on the configuration, but you must consider peak moderator temperature.

And the materials of construction are essentially the same between baskets used in spent fuel pools and baskets used in transportation casks or storage casks.

They are typically stainless steel with neutron poison plates, typically either boral or a metal matrix compound; and the physical dimensions, openings and spacings are similar between Part 50 -

between racks in Part 50 and Part 72 or 71.

Now I'll touch on some of the modeling differences. I've listed a number here. I am not going to hit all of them. I am going to focus on a couple fo these.

In terms of manufacturing tolerances, in Part 50 when we analyze spent fuel pool racks, we analyze it using for example what I've done historically myself in my previous life, MCMP, and you analyze it with nominal dimensions.

Now you take into account manufacturing tolerances of the racks, the deviations of the tolerances associated with that, by applying a delta k. In Part 71 and 72 the guidance is such that the basket must be modeled in the most reactive physical configuration.

In other words you are basically assuming that the basket is built perfectly in whatever form that is that would result in the most reactive configuration.

So you have to do analysis to determine if plus side of tolerance on wall thicknesses is more reactive; minus sides, all of that, and analyze it in the most reactive configuration.

For eccentric position in a fuel assembly, which means fuel assemblies positioned off center, in Part 50 you have to account for delta k associated with it, but before you look and see if fuel eccentricity has a positive effect. If so you account for it.

In Part 71 and 72 fuel must be modeled in the most reactive eccentric position. Now why do I bring this up and what does this mean? This is a diagram of an MPC-32 from Holtec International. And there are 32 fuel locations in here.

In the case of the eccentric position in here, what it means is that the four quadrants basically have to have the fuel assemblies move toward the center. So the quadrants, the fuel assemblies in these locations here all come in, and these locations all come in, such that along the central axis there you have fuel assemblies as close as they can be to each other, and then they are spaced out accordingly in the other direction.

And this does result in a fairly noticeable change in reactivity.

Now if you recall the regulations, when I mentioned the regulations, it said, most reactive credible configuration. Clearly moving all four quadrants inward is not what one would consider most reactive credible configuration, not for transportation anyways. If you had a transportation accident where water were to get in, obviously all the fuel assemblies would move, but they are not going to end up reconfigured in all four quadrants coming in.

Likewise during loading, yes, fuel assemblies would be distributed, but it's considered, in our opinion, not a credible configuration that you would actually load all the assemblies in this manner as well, all four quadrants perfectly.

Likewise basket - I mentioned previously the basket modeled in the most reactive physical configuration. Again regulations talk about most reactive credible configuration. We don't view that as the most reactive credible configuration either.

So I highlight some of these differences between Part 50 and Part 71 to point out some of the additional conservatism that is inherent in the Part 71 analysis compared to the way it is done in Part 50; and also the same is true in Part 72, because your analysis, your physical modeling techniques are the same in Part 71 and Part 72.

Now we'll touch on a couple of the items that are big ticket items here. In Part 50 the way the isotopes fission products, for example, and actinides are treated, we do site specific depletion parameters, use site specific depletion parameters, for the analysis.

Your Part 50 facility, your reactors are analyzed in their spent fuel pools, and they are using the characteristics of their fuel for their analysis, and they are submitting license amendments to the staff.

All actinides in fission products are accounted for using core analysis codes like CASMO for example, same codes, same techniques, that would be used to analyze the reactor, that are used to analyze a reactor, are used in that analysis.

And typically a depletion uncertainty equivalent to about 5 percent of the reactivity decrement from fresh to bush is applied to account for possible uncertainties associated with the depletion codes.

This is the way Part 50 has been done for years, and the way it continues to be done. Again, I mentioned, all actinides in fission products are accounted for, and that's an important point.

And attached specific depletion parameters is important as well, and one that I will touch on again a little bit later.

Now in Part 71 currently generic depletion parameters are used. By that I mean the cask vendors analyze a large number of fuel assemblies to go in the casks. They want to try to cover as many of the fuel assemblies out there, as many of the plants out there as possible. So they do things on a generic basis.

This is not to say that they couldn't do it site specifically. It would be a little bit more complicated, but it certainly could be done. And I'll touch on that a little bit later too.

ISG-8 Rev 2 permits actinides only currently. However, the staff has approved at least one cask vendor with some limited fission product credit. And they are entertaining applications from some other vendors at the moment.

Now what does limited fission product credit mean? In this particular case the code's ability to calculate CASMO for example, the ability to calculate each individual isotopic composition or concentration, sorry, has to be benchmarked against chemical assays, and a bias applied for each isotope.

So what this means is, for example, if you do your calculation of a fuel assembly at 45,000 burnup and you come up with an isoptopic composition. You had to have done some benchmarks with chemical assays of different fuel assemblies, and you come up with adjustment factors that do need to be applied in a conservative direction only for those isotopic compositions, and then do your criticality analysis.

This is extremely conservative and results in a large change in delta k and results in limitation on the number of fuel assemblies that can be stored.

Note that the fuel assembly is an integral part of all of the - the isotopic composition is an integral part of the fuel assembly, and the codes that are used to calculate the depletions as I said are the same codes that are used in the reactor analysis.

One would never think of adjusting the isotopic compositions out of your reactive core follow calculations based on the sort of benchmarks like this. And when doing these benchmarks one is considering that the measurements are perfect if you will, and that those are what needs to be compared to.

So this is one of the areas of the big sticking point, if I can use that phrase, for industry in regards to isotopic compositions.

Now to give a little idea on acceptance criteria between Part 50 and Part 71 and Part 72. All three can have limitations on maximum fresh enrichment, in other words basically saying that the fuel assembly with enrichment less than 4 percent is permitted for storage or permitted for transportation.

In Part 50 and Part 71 we also have burnup versus enrichment curves, and I'll show a couple of those. And those burnup versus enrichment curves basically say that a fuel assembly with an enrichment of 4 percent must have a burnup greater than, say, 40,000 to be permitted to be stored or transported.

Now in Part 71 in the one application that I have seen approved so far with fission product credit, or with burnup credit, I'm sorry, the curve may vary depending on the location of the fuel assembly during irradiation, so for example there are limitations on that certificate that says if the fuel assembly was under a control rod bank for X number of hours or such criteria then it is permitted for transportation, or it has a different loading curve.

These sort of restrictions don't exist in Part 50. In Part 50 we do the analysis - I say "we", I shouldn't say it that way, sorry, I'm back in my old life - in Part 50 the analysis is done in such a way that it shows the single burnup versus enrichment. And the ramifications, well, one might think that the ramifications are putting in limitations on control rod bank position for example are no big deal. They can be, because the information concerning duration of time for example under control rod bank may not be readily available at the utilities.

Now in Part 72 the requirement is minimum soluble boron level specified as a function of fresh enrichment. So for example in a storage cask you would have 4 percent enrichment, and you may have a soluble boron level of 2200 PPM, 5 percent fresh enrichment you need a soluble boron level of up to 3000 PPM for example.

This is important to note because the plants typically operate their spent fuel pools at about 2000 PPM, so when they go into loading campaigns, they need to, for storage, they need to ramp up the soluble boron level, which can be as high as 3000 as I said depending on what you are loading and the specific cask. And then afterwards they need to bring it back down.

Now why is this a difficulty? Well, it generates a lot of additional waste which is unnecessary for the plants. And it's an additional operational burden.

In our opinion your storage casks basically look the same as your rack that's there. It's a small rack if you will, spent fuel rack. And if you have the analysis techniques the same as Part 50 you wouldn't this additional operation burden, and you would have the same consistency in analysis approaching consistency in requirements.

So that is something to keep in mind in regards to Part 72.

Now as I mentioned Part 50 has burnup versus enrichment curves. And what you are seeing here is a burnup versus enrichment curve for a high density wet storage rack. High density means that there are no gaps between the plates separating fuel assemblies. So there is no flux traps, if you will, or water gaps.

And you are looking at, for 5 percent, a burnup of about somewhere between 35 -- 40,000 is necessary.

And this is analyzed with no soluble boron, no credible soluble boron, for k's less than .95.

Now in Part 71 these two curves were taken out of certificate 9261, and the configuration A, the blue line, is one of the configurations I mentioned. I think there are up to four configurations in there depending on position of fuel assembly and the core during irradiation.

MR. REDMOND: And I have put up here as an example, for illustrative purposes, the dashed line is the burnup versus the enrichment curve that would be based on just strictly IFG-8 actinide only.

Now while it looks like those two curves aren't that different, and they peak out at 50,000 burnup, you will see in a second that these are significantly different than the Part 50.

But here all the curves are present, the Part 50 and this is the transportation curves. I've also put on here a dashed line on the side here indicates basically Part 72.

As I said Part 72 uses soluble boron so you can load basically any fuel assembly in the spent fuel pools. So any enrichment that is permitted, any enrichment burnup combination is permitted for storage.

Now let's overlay this with Westinghouse 17 X 17 fuel assemblies, taking out of the DOE RW 859 database for 2002. What you see here is, you've got your Part 70 -- or Part 50 curve again, and over 98 percent, 99 percent actually, sorry, of the fuel assemblies are permitted for storage in the high density racks in Part 50.

All of these fuel assemblies are permitted to be loaded for storage.

Now in transportation, then, we have -- here is the blue line and there is the ISG line. So if you were to do a FGA, you don't want to be able to load 21 percent of those fuel assemblies for storage, and in this case of the blue line that's been approved, that takes you up to about 49 percent of the fuel assemblies.

Now I highlight this as a point because the industry is loading high density dual purpose canisters now, some that may have some guidance in regards to transportation, some that may not, because some of the vendors have not submitted transportation applications, and the game is still changing in regards to burnup credit.

So we have fuel assemblies that are being loaded that are obviously coming out of the spent fuel pool, and that are actually being loaded in the cans that are going into storage now, that at some point in time may or may not be transportable based on analysis techniques and the regulatory guidance at the moment, and I'll touch on that also in a second.

To summarize here, Part 50, Part 72 and 71 criticality analysis methods differ significantly due to NRC review guidance. As a result, as I said, fuel currently being loaded in high density DPCs, or in the DPCs, may or may not be transportable.

And as I pointed out with Part 72 significant operational difficulties - or significant in my view -- arise during loading campaigns for storage, due to the high soluble boron requirements, where you have to ramp the soluble boron level up prior to loading, and then ramp it back down afterwards.

Now I want to touch briefly on risks. At the presentation we gave in March on moderator exclusion, Albert talked extensively about the risks associated with transportation.

And in our view enhanced burnup credit -- and by enhanced burnup credit, I mean burnup credit that resembles more or picks up some more of the characteristics of Part 50 type burnup credit as opposed to where we are right now in Part 71 -- should be considered because of the extremely low probability of a criticality accident, typically on the order of 10 to the minus 18^{th}, 10 to the minus 17, per trip.

Now I put the second bullet here, because I just want to put in context a little bit, the Part 50 permits analysis as I said before demonstrating the k-effective just needs to be less than 1.04, the complete loss of soluble boron, which is an extremely low probability. I don't have a number for that, but as we can all imagine, an extremely low probability for that.

Now with these risks in mind, and the extremely low risk of a transportation accident in mind, we think that there are some solutions here. And the following are some of the solutions that we see.

Permit Park 71 and 72 criticality analysis to be performed with Part 50 burnup credit analysis methods either generically or site specifically. I mentioned bring this back again, generically or site specifically.

One of the issues that we have heard from staff is that the Part 71 analysis is done generically; it's done to cover a large number of fuel assemblies, a large number of reactors.

This is true, and there are some potential difficulties associated with that, because you need to take bounding conditions to cover all the plants you're choosing to try to cover.

There is no technical difficulty associated with doing analyses, transportation analyses that are specific to a site, similar to what is done for Part 50, spent fuel storage racks.

What we need would be some guidance from the staff to permit us to do that, and we feel that if that sort of thing -- if that sort of opportunity is permitted, then likewise some additional Park 50 similar burnup credit methods should be used.

Another option here is to recognize moderator exclusion or leak tightness in the licensing basis similar to what we discussed previously.

There is also a possibility of a combination of the above, kind of a defense in depth if you will, burnup credit for example backed up by moderator exclusion, so in other words you could permit your burnup credit analyses to be done very similar to Part 50 with the big ticket item being the fission products for example be treated the same as they are in Part 50, backed up by moderator exclusion in the sense that we demonstrate that the casks are going to remain leak tight during a transportation accident.

I would remind the committee that there is an ISG-19 I believe that deals with high burnup fuel that does permit the vendors to show the casks are leak -- or do not leak during a transportation accident to deal with the criticality there.

The other option here is moderator exclusion backed up by burnup credit. Well in that case it's the same thing. Your moderator exclusion, you demonstrate the potassium is going to remain -- keep water out during a transportation accident. But as a defense in depth you do burnup credit analysis similar to Part 50 and you come up with allowable burnup versus enrichment curves for fuel that goes in, so you have the best of both worlds then. If you have burnup versus enrichment curves, which -- back up for just a second -- burnup versus enrichment curves that are similar to Part 50 here. So you are picking fuel assemblies that would be subcritical, guaranteed to be subcritical with k less than .95 in freshwater.

But you also have moderator exclusion there, which assures that even if something did happen water doesn't come into the casket. In our opinion that is the best of both worlds.

Okay. Now in conclusion our view is all used nuclear fuel currently stored in spent fuel pools should be transportable in DPCs. As I mentioned, and as I just showed again, you have spent fuel racks in the spent fuel pools that have 99 percent of the fuel that is out there stored in high density racks. Those should be able to be transportable in DPCs in our opinion.

As I've said before Part 71 and 72 criticality analysis should include an option of using Part 50 type methods to achieve this goal, and also to reduce unnecessary operating burden.

If a plant wishes, and a vendor wishes, to go to Part 72 and do analysis basically the same as you would in Part 50 to alleviate the high soluble boron level requirements, then we think that should be permitted.

And as EPRI will discuss, or as Albert will discuss in just a moment, measurement of fuel assemblies prior to loading in our view is definitely not necessary.

Now I'll point out one other thing here. And that is, a question asked yesterday during the NMSS briefing. And that question was, how many casks would need to be repackaged prior to going into the mountain, and where -- the logical follow-on is where would those need to be repackaged?

Well, there are currently over 130 casks that will require some form of burnup credit for transportations out that have been loaded. There are additional casks that are being loaded every year. And the TADs are not scheduled to come out until I think 2011 or `12. So prior to that there are going to be a significant number of casks that are loaded that will require additional burnup credit.

If progress is not made in this regard, towards, in my view, advancing more toward Part 50 type burnup credits, those 130 plus casks may need to be repackaged, and that would probably need to be done at the site, at the utility reactor site rather than at a central facility.

So just adding a little bit more information to one of the questions that was raised yesterday; something to think about. We would obviously like to -- and feel that these casks should be transportable, and that NRC should be -- that the regulatory guidance between Part 50, 71 and 72 should be consistent.

And that concludes my presentation.

DR. WEINER: I'm going to, in the interests of time, I am going to let Albert go ahead, and we will hold questions until the end.

MR. REDMOND: Sure.

DR. WEINER: Albert. Welcome, again.

MR. MACHIELS: Thank you very much, Dr. Weiner.

Good morning. Thank you for the

opportunity to come back to this meeting, as was already indicated we had a presentation on moderator exclusion, and they asked me to talk a little bit about burnup credits; that's what we are doing obviously.

I'm going to talk about fuel burnup measurement which is a very highly sensitive issue with utilities. It has a very high level of interest. And because those measurements result in significant operational burden, and clearly if the burden is being justified by safety reasons, there is obviously a good reason to do it. If it's not the case, then it's really a burden in the true sense.

So what I am going to do is that I am going first of all to just present the conclusion from a fairly lengthy presentation just made to the NRC back about a few months ago. We will stick here with the ISG-8 requirements, talk about burnup, burnup accuracy.

And clearly from a safety point of view is that what is happening when you put into your cask, and that has a burnup that would be significantly lower than what you would think you would put in your cask.

And then I will reiterate the industry

position.

So in order to avoid any misunderstanding about what the industry perspectives are this morning is the following, the requirement to perform in-pool measurements, and I want you to specifically pay attention because I am going to distinguish between in-pool measurement, which is the kind of measurement that is being requested by the staff, versus in-reactor measurement, where in-reactor burnup measurements are made on a regular basis.

So the requirement for performing in-pool burnup measurements is burdensome without commensurate benefits to the health and safety of the public. In fact they believe there is more detriment than benefits in performing this operation.

This was part of a presentation, was a conclusion of a presentation made by Steve Nesbit from Duke Energy on October 12 to the spent fuel -- sorry to the transportation division.

Now ICG-8 rev two is very explicit, is that it says the administrative procedure to the group of measurement -- and it's intent here is to request an in-pool measurement. So after the fact.

And on top of that it is also some clarification about how to correct the value of the burnup by taking into account uncertainties associated both with the declared burnup coming out of the reactor records as well as the added uncertainty of the measurement itself.

Now burnup as you all well now, this is an integral property, this is the power which is produced by assembly over time, run by given amounts of fuel, and we are assessing, or the burnup is assessed by doing in core measurement on a continuous basis, on a monthly basis for example there is instrumentation in the core which is giving you to give you a flux map and another result from knowing the distribution of the flux, knowing that the fuel that you have, you basically calculate the burnup on a regular basis, and you update your record.

And you can do also this type of pre-calculation or extrapolation between the measurement using a flow-type CASMO that Everett has already mentioned.

Now we certainly believe that the quality of these in-reactor measurements, the way you measure burnup during the reactor operation, is far superior to the manipulation that you perform in the pool after reactor discharge.

Now burnup is obviously a property, a

parameter that is used constantly. It is used in Part 50, it's used in Part 72, it's used in Part 74 for the core design, for the criticality analysis, as mentioned a few times, and so on, to declare the k property value and so on.

And in no cases in the existing practices does it require a burnup measurement. So we are relying a lot on burnup in a variety of contexts which doesn't require burnup measurement.

So the requirement that is in Part 71 is kind of unique from that perspective.

Now this is the result of some work that was presented to the NRC. And this is EPRI work which compares the measurement of burnup versus what was calculated by CASMO simulator. And there is very good agreement between the two that show the distribution, the number of burnups which have a deviation of less than 5 percent in one direction, less than 1 percent, and so on. So this is the comparison between assemblies which were very close to instrumented loops and compared to the CASMO. It really doesn't matter for this purpose, because what we are using, what we are declaring as the burnup is really the outcome of the in-reactor measurements. We are not relying on the reactor records. They just show the feedback, the continuous feedback, that you have during reactor operation between the tools that you are using and the measurement that you are making and the consistency obviously of this inspires a lot of confidence in how you are running your reactors, and how you are doing your other operations like reload and loading and so on.

Now, let's look now at the impact of making mistakes, because we do make mistakes. And this is a study that we did at EPRI. What it shows is the learning curve. And this is a cask which was some neutron poison in it, so you can put fresh fuel up to two percent.

Now after two percent, the initial enrichment was higher than two percent, then you get this black curve, and then you need to take into account some credit for the burnup.

Now the black curve would be the curve that would give you the k-effective of .95. And as long as you stay on this side and you have an acceptable range and here on this side the unacceptable range.

So what we did is a parametric study starting with different enrichment, 3 percent, 4 percent and 5 percent. And we assume, focusing for example on the 5 percent case, we assume a nominal burnup of either 45 gigawatts per metric ton or a nominal burnup of 35. And then we assume that instead of loading 45 or 35 we are loading something which has a burnup of only 25.

So we are going to see simply just an extract of those results. This is the k-effective here, assuming that you have an initial enrichment of 5 percent, and the core is 45; and if you don't make any error, or I should say if your burnup is truly the 45, then you get the k-effective which is in the neighborhood of .85.

Then what you do here, there is a loading of one assembly in the center which instead of having 45 now only has 25. And you can see obviously the k-effective going up as a result of that.

Then you do -- and you start within your second assembly, which again has burnup of only 25. And then a third, fourth, fifth and so on. And you can see the k-effective creeping up obviously.

Now in this case you can see that you still are very far from approaching any criticality issues which is measured by the k-effective. So one misloading, three misloading, four misloading, or commensurate error in your burnup basically would still keep you basically in the safe situation.

Now the NRC is more conservative, and what they do is that they assume that you are directly on this curve here. So that means in this case that you would be loading 5 percent initial enrichment with burnup on the order of 30. And that means that in this curve, instead of starting at a value like this one, you would start at a value of about .95.

And you can see that it would still require basically several misloadings before you can actually get close to the criticality value.

The only way -- the only way -- to really go to criticality is to really start loading fresh fuel assemblies, and fresh fuel assemblies with a very initial enrichment, 5 percent in this case.

In this case you will see a jump of about .06, so in this case it will take about three misloadings of fresh fuel assemblies to get beyond critical.

If you want to be very conservative like the NRC would be, and start from something which has a very low burnup far from .95 and 1.0, fresh fuel assemblies would bring you into the -- above the criticality bar.

Now -- now obviously, misloading of fresh fuel assemblies is pretty hard to do. We have no such records.

There are two good reasons for that. This is the appearance of a once-burn fuel assembly; this is the appearance of fresh fuel assemblies. So there is clearly a visual impact. And given the procedure that the plant is going through during loading, it's hard to miss something like this.

On the other hand the second fact is that typically loading of casks is being done in the middle of a cycle, not to interfere obviously with refueling, and in the middle of the cycle, typically, there is no fresh fuel in the pool to start with. The fresh fuel to the pool is being brought obviously just before refueling, and during refueling operation.

So you have a likelihood of putting a fresh fuel assembly, and it would have to have a 5 percent one in order to get into something which would obviously raise safety issues.

So the result of this report were actually shared with NRC at the -- one of the annual meetings that occurs between the NEI and the industry public in general. That was back in 2004.

And at that time Wayne Hodges, which was at that time the deputy director, and now I should properly say was the former deputy director, responded by stating to the EPRI presentation that an ongoing NRC sponsored study at Oak Ridge National appeared to confirm the EPRI result. That means that the misloading of the burnup assemblies would not violate nuclear safety.

They did a somewhat similar operation. They looked at two misloading, two assemblies that would be 75 percent underburned. That means the burnup would be only 25 percent of the declared burnup. They also looked at four assemblies which were only half burned, and they looked also at assemblies which would be systematically, all of them, 20 percent below the declared burnup.

In all cases they found that the increase in k-effective was below the administrative margin of .05.

And you can see that -- to me the telling one was the one that assumed that everything is -- the mistake is 20 percent on all the assemblies. That means an operator thought that this reactor was operating at 1,000 megawatts when in fact it was operating at 800 megawatts. I don't think they make that kind of error.

So anyway the reaction at that time was

there was some encouraging statement from Wayne which said that there may be a path forward to eliminate those measurements. And this is a direct quote from Nuclear Fuel. And then they also however, this is not a quote from Wayne, this is a quote from the writer of Nuclear Fuel which says that while the NRC could develop new guidance to eliminate the measurement, such projects are generally low priority because of the large case load of the special project office at the present time.

So we are at this point we are still discussing about burnup measurement. I think that in the context of the risk information context we talked about last time, first of all, even of any challenge in transportation of a criticality accident is essentially zero.

So we are talking about acquiring a burden of measurement which obviously cannot be justified on the basis of its safety significance. It just would give you a warm feeling that what you have done is correct, but there is absolutely no significance.

So from that point of view, the industry position has been that these spent fuels storage and transportation division should revise its regulatory guidance to delete the requirements of in-pool measurements, understanding that there are a lot of in-reactor measurements which are done on a continuous basis in order to come up with the burnup which is declared in the records.

Fuel assembly burnup is already well characterized in quality records, Q/A procedures and so on. It shows good comparison in terms of the roughing, the benchmarking, and the feedback with the methodologies and measurements.

It's consistent with all the regulatory practice in other parts of the regulations.

It provides for -- the existing approach provides for reasonable assurance of public health and record, and if anything in-pool measurements would have adverse consequences in terms of the additional fuel manipulation; the access of personnel to a vital area; the occupational exposure; as well as some low level -- some generation of level of waste.

So I think this is a scenario where I think the industry feels very strongly that terminating the parameter of measurement is really a key consideration for them to consider burnup credit, because they don't see any benefits, only detriments, to the part.

Thank you.

DR. WEINER: Thank you both for a really very thorough and excellent presentation of a very complex issue.

I'm going to go ahead and ask Allen to start the questioning.

VICE CHAIR CROFF: Thanks, and I agree, this has helped sort of lay out the issues for me very clearly.

One question: both of you in your talks have emphasized guidance. Would any of the changes that you have suggested require changes to the regulation per se, Part 71 or 72 or 50, as opposed to the guidance associated with the regulation?

MR. MACHIELS: Burnup credits is not in the regulations. There is only a statement which says you have to know the content of the fuel they are putting there.

So from that point of view this is more of a matter of regulatory practice of what is acceptable to the staff. There could be some changes in the regulations in the risk informing Part 72 because presently Part 71 is very prescription. And that was mentioned last time, and I think that Everett touched upon that also, is that it talks about the fissile materials in general. So it doesn't matter whether you are shipping pure plutonium, enriched uranium or spent fuel, they are all treated the same.

And clearly, what can be highly justified in some cases is an overkill in other cases.

So from that point of view --

VICE CHAIR CROFF: I want to make it clear here on my question, what I'm asking is whether any of the changes you suggested require that the regulation be changed, or is this all in guidance?

MR. REDMOND: No, what I was focused in terms of comparing -- making Part 71 similar in analysis to Part 50, we are talking about could be done within the guidance, within the context of the interim staff guidance for example that is out there.

Obviously conversations we've had in the past in terms of moderator exclusion may or may not require regulatory changes. We don't think so, but the staff might have a different view in that regard.

As far as burnup credit, no, that can be done within the context of the current regulation.

VICE CHAIR CROFF: Okay, thanks.

DR. WEINER: Would staff like to comment on that?

MR. HACKETT: I thought I'd just comment on what Everett just said.

DR. WEINER: Tell the reporter your name.

MR. HACKETT: I'm sorry, this is Ed Hackett from the SFST staff. I'd comment on the comment that Everett just made on moderator exclusion.

As the committee knows we have a paper that is going to be coming before the commission, because there are policy issues associated with full use or implementation of moderator exclusion. There are some partial implementations that could be permitted through the current guidance. But that would be done that could easily impact the regulations.

VICE CHAIR CROFF: Okay, thanks.

DR. WEINER: Bill?

DR. HINZE: Well, this has been very helpful. Let me ask a question about these 130 some odd DPCs. How much do you see them needing an overpack or some kind of cannister to put them directly into the repository without any further opening and so forth, transfer?

MR. REDMOND: Currently the repository -- I'm not the best person to answer that question -- but the repository currently is analyzing for TADs. So at the moment given the current approach they would need to be repackaged to go into TADs.

At some point in time there may be a possibility that analysis could be done to permit them to go into the mountain. I'm not the person -- Rob McCollum of the committee might be able to comment a little better in that regard.

DR. HINZE: I think that would be very helpful for me to have some idea of what the answer to that is.

DR. WEINER: Rob?

MR. McCOLLUM: Yes, this is Rob McCollum. I think Everett answered the question correctly. Right now the licensing basis for Yucca Mountain is based on TAD containers. There hasn't really been any detailed analysis of putting DPCs into the mountain in the Alloy 22 overpacks. But that is not to say because the Yucca Mountain licensing process allows for progressive amendments over time, and we are going to be loading Yucca Mountain over a long period of time, yet as we begin loading TADs, and we still have some DPCs out on the parking lots, that that analysis would not be worth undertaking, and perhaps, I don't know when in the future, but at some point there could be a license amendment come forward on that.

But the first step is making them transportable obviously.

DR. HINZE: Thank you.

DR. WEINER: Yes, Bill Branch.

MR. BRACH: Bill Brach from SFST. Maybe if I can help clarify. There are roughly approximately 850 storage casks that are loaded today at the multiple sites across the U.S. Going back to 1986 when the first cask was loaded, the casks in the early years were only loaded under the Part 72 storage, so that all of those casks that were loaded in the early years were loaded solely as a Part 72 storage cask only.

And I think going back to Everett's earlier point that the number, 130 or so, the number, I believe the point that Everett was making is that a number of these casks that have been loaded going back to 1986, for those casks to be transported either to the repository or to another facility, there would need to be approval of request, authorization and approval for a storage overpack in which these previously loaded storage only casks might be demonstrated to be acceptable under Part 71 to be transported, whether it be to the repository or to another location.

The secondary part of your question dealt with the eventual disposal of these canisters. And I think Everett was addressing the TAD and Rob McCollum as well.

But I believe that question that Everett was putting on the table earlier dealt with the storage-only casks that have been loaded going back to 1986, and the ability to transport those casks without repackaging to another facility.

DR. WEINER: Would those casks physically be transported?

MR. BRACH: It depends on the nature. There are some casks -- the VSE-24 is one example that comes to mind -- it is authorized under Part 72 for storage only. It does have a welded cannister internal to that storage cask design. And there have been efforts by the vendor looking as well as the possible transportability of that cannister if taken out of its storage configuration and that cannister placed into a transportation overpack, and then transported to the repository or to another facility.

So it's possible. Those are activity reviews currently underway right now.

VICE CHAIR CROFF: I had a brief follow up for staff. When might we see that paper on moderator exclusion?

MR. BRACH: The moderator exclusion paper mentioned yesterday very briefly, we have revised that based on our interactions with the committee this past spring and early summer in an exchange of correspondence.

That paper is in draft right now by the staff, and we are looking toward late summer being probably hopefully next month that we would have that paper -- August having that paper to the commission.

VICE CHAIR CROFF: Okay, thanks.

DR. WEINER: Ed, you had a comment?

DR. CLARKE: No questions. Let me just join my colleagues in thanking you for two very helpful presentations on what is to me very complex issues. Thanks.

MR. ROUSE: I have kind of a detailed question for Albert.

Could you go back to your next to last slide please? The probabilities that you mention there, do those correlate with the k-effective measurement curve that you showed for misloadings and so on? Is there a correlation between those?

MR. MACHIELS: Yes. The probability of the criticality accident depends on a set of parameters which have nothing to do first of all with the cask itself; it's how often will the rail car derail, and at what speeds, and this type of things. And from there you get to a certain number, which is -- I think that Sandia and Livermore have been actively involved in those areas.

Then the next step is then to assess what is the probability of doing damage to the cask. And then what is the probability that there will be water present.

Then finally then there is the probability of having a critical configuration in the cask. So that means, do you have something in the cask that you didn't intend to have. And this is where then the formal evaluation of human error in terms of misloadings come into the picture.

DR. WEINER: So you do incorporate at the end of the last probability is the probability that that k-effective exceeds one or gets too close to one?

MR. MACHIELS: Right, and we assume conservatively in that risk assessment that one misloading is enough.

So after we kind of rule out the fact that it is possible to make a mistake of loading a fresh assembly, we say, okay, the heck with it, we are going to assume that one misloading is enough.

DR. WEINER: Could you go back three slides to the two curves? That one.

Is that bottom curve, is that an asymptote, or does it keep going?

MR. MACHIELS: Yes, it's asymptotic.

DR. WEINER: Thank you.

MR. MACHIELS: This assumed that there is one misloading of the center, then one next to it, and then next to it. Because you have to put them together essentially for having the maximum effect.

So if you were randomly going to have an underburned assemblies randomly, it will not have the same impact; it will be lower than that.

Again, in the spirit of being conservative. But more realistic than --

DR. WEINER: Thank you.

Staff? Questions. Antonio?

MR. DIAS: Just one question. This is Antonio Dias, the NRC staff.

What's the code that is used to guarantee criticality, verify criticality in Part 50? Is it simulate? Is it a package CASMO simulate?

MR. REDMOND: For spent fuels?

MR. DIAS: For the pool.

MR. REDMOND: It's typically NCMP that are used, and then they'll do CASMO calculations, or it can be a combination of CASMO and --

MR. DIAS: But they all -- how far they go, especially the dimension of the pool, how do they address that?

MR. REDMOND: Typically the pools are assumed to be infinite. If you are --

MR. DIAS: We are using an NCMP for an infinite?

MR. REDMOND: Well, for example if you are storing fuel in the center of the spent fuel pool, you would assume that for all practical purposes the spent fuel pool was infinite in the X and Y directions.

Now when you move to the edge of the pool you may have some complex loading patterns that do take into account the geometry and the wall of the spent fuel pool, and there is where the NCMP comes into play.

MR. DIAS: And I believe that one of the reasons the staff has been a little hesitant, I would say, and I have nothing to say about Part 50, but there is definitely a totally different model approach when you go to a cask. It's definitely a very finite geometry. It's definitely no infinite medium whatsoever.

And has anyone verified that the nuclide concentration, the radio isotopes concentration, fission product that you derive from the CASMO -- which by the way CASMO and simulate, they never use that; they are using the macroscopic approach -- but has anyone verified how good, if you put that into MCMP or maybe SCALE, how good of a prediction you'd do? How good is this migration of data from one package of codes to another quite separate code? Has anyone verified that?

MR. REDMOND: Yes, there are some reactor criticals. There's data out there that has been collected on critical configurations for reactors, and the vendors have analyzed that by doing the calculations, or in the case of Oak Ridge National Laboratories, the origin calculations.

MR. DIAS: Okay, what kind of burnup were they talking about?

MR. REDMOND: Well, you'd have a mixture of burnups within the core from fresh fuel assemblies to burnups maybe upwards of 40.

MR. DIAS: Okay, thank you.

DR. WEINER: Yes, John.

MR. FLACK: John Flack, ACW&M staff.

I'm looking at -- I'm thinking about these numbers that were put up on the board, incredibly small numbers. I mean when you are talking about 11,000 trips with still probabilities as low as 10 to the minus 13 or 10 to the minus 15, one has to kind of question what went into that analysis.

And I see that with the possible misloading you are already at 10 to the minus one, 10 to the minus two. So that means you are looking at 10 to the minus 12 for an accident to occur to reach criticality. That is incredibly small.

What actually went into that analysis? Is that analysis available?

MR. MACHIELS: Yes.

MR. FLACK: And what kind of accidents were consider and the situation?

MR. MACHIELS: I have sent the report to the NRC staff, and you would be welcome to have one obviously.

MR. FLACK: Thank you very much. Okay.

MR. MACHIELS: But when you are saying a misloading error of 10 to the minus one, 10 to the minus two, is actually lower than that.

MR. FLACK: For 11,000 trips we're talking now.

MR. MACHIELS: Oh for 11,000 trips? What we evaluate is the human error probability of doing a misloading in the context of the plant operation, not the procedure that you use -- and we come up with a number, and then we do the calculations for one trip, and then we multiply -- we assume 2,000 miles per trip, and there are a number of assumptions which are made.

But I would be more than happy to give you a copy of that report.

MR. FLACK: Just for clarification, it is for 11,000 trips?

MR. MACHIELS: Yes, it is for the -- the 11,000 trips come from a DOE report which assume that is the number of trips we will need to basically load everything into Yucca Mountain. That's where this number is coming from.

MR. FLACK: Okay, what kind of uncertainty would you put on that?

MR. MACHIELS: Well, you know, I talked to the analyst, which is a very reputable organization, ABS Consulting. And the answer was that also recognize that those are century point estimates. When you get into those numbers it's not worth the spending the money to do a study and analysis, because the errors, whatever they are, are such that the numbers are so ridiculously low that it really doesn't have much of an impact on the conclusions.

MR. FLACK: Of course unless it's seven orders of magnitude or something like that?

MR. MACHIELS: Well, yes, but I think there is enough in terms of Federal Railroad Administration database and so on, there is a lot of information on those issues, not like we're plucking that out of the air.

DR. WEINER: Just to add to Albert's response to your question, if you just take the accident frequency all by itself, recognize that the accident frequency for a rail car is order of magnitude, 10 the minus seven, 10 to the minus eight, per kilometer.

So right there you are getting just up front you are getting a very small number.

MR. FLACK: Depending on the number of kilometers that are totally driven on 11,000 trips.

DR. WEINER: Yes, if you say Albert's 2,000 kilometers, that ups it to 10 to the minus four, 10 to the minus five.

MR. MACHIELS: I think the sequence is that we will give you the report, and we would welcome your comments.

MR. FLACK: I will be happy to provide

comments, thank you.

DR. WEINER: Do we have any commenters or questions from the audience?

Come up and please state your name for the reporter.

MR. GUTHERMAN: Brian Gutherman from ACR Nuclear. I wanted to go back to Dr. Redmond's possible solution slide. It occurred to me that a potential pathway forward for addressing these generic fuel versus the specific fuel issue may be, rather than having cask vendors do a multitude of analyses, criticality analyses, for all the different fuel types, could they not have a methodology approved whereby the users of the cask can then do the analysis considering their specific fuel for that particular transport application.

I just throw that out there for consideration because it seems to be a path forward that wasn't included.

MR. REDMOND: That is certainly is something that would be of interest to industry as a whole for sure.

DR. WEINER: Do we have any staff comment?

MR. BRACH: Let me -- I appreciate the comment by Brian Gutherman. In the essence of time, let me go back to yesterday's discussion when I presented SFST issues that might be of interest to the committee.

The very first two issues on the list were moderator exclusion and burnup credit. And I would support the comments of both Everett Redmond and Albert Michaels have made with regard to this being a technical issue that we need to identify for resolution and a path forward.

As noted, a lot of packages, casks, are being loaded today that need to be transported to the repository or to another facility, and we need to address the transportation issue.

So I'll take the comment/suggestion from Brian as a consideration as we also look at the resolution paths forward of whether it be moderator exclusion combined with burnup credit.

And I'd also note, it wasn't mentioned earlier, but there is a collaborative effort that NRC and DOE have, and others have underway right now, to acquire additional burnup credit data that hopefully provide some of the information and data that would support expansion of burnup credit in fission products in other areas.

So I will take the comment from Brian

Gutherman into consideration as we collectively look to see how we can solve this issue.

DR. WEINER: Thank you.

Any other comments?

Hearing none, I will turn it back over to the chair.

VICE CHAIR CROFF: We will take a 15-minute break here until 11:00 o'clock.

(Whereupon at 10:44 a.m. the proceeding in the above-entitled matter went off the record to return on the record at 10:59 a.m.)

VICE CHAIR CROFF: If you will take your seats, we will proceed with the rest of the morning agenda which concerns transportation, aging and disposal casks and the first talk, Member Ruth Weiner of the Committee is going to summarize the specifications. Folks, please. Ruth, proceed.

DR. WEINER: Thank you, Mr. Chairman. What I'm going to do is this is for the benefit of Committee staff and everybody else who doesn't want to read all the way through the 365 pages of the Transportation Aging and Disposal Canister specifications document. So all that I have done in this presentation is to summarize some of the major features of this document. I'll say right up front, there is a section of the document that deals with construction of the GROA and with the soil stability and the rock stability on which the GROA, the operations area of the surface facilities are being constructed and this is well beyond any experience I could even pretend to have, so I'm just not going to discuss it. That will be covered in another presentation later on in the year.

So the -- this slide just gives you the contents of the TAD canister system performance specifications. There's a description of the TAD system, the performance requirements for the TAD cannister for the transportation overpack. These are the specifications for the transportation overpack and for the aging overpack. Then there are a series of appendices or attachments. The first gives seismic data for the GROA. There are loading curves for post-closure criticality, criticality once the TAD is has been placed. There is one that describes the lifting features for the TAD, details on the aging overpack and a supplemental report on soils.

The TAD system consists of the canister itself, the transportation overpack with a skid and the aging overpack. The overpack that's the TAD will be put in for aging on the surface. Not included in this report but probably eventually part of the description of the GROA are any ancillary equipment, lifting and transporting equipment. The shielded transfer cask, which transfers the TAD from the transport cask to either the aging cask or into the repository to the waste package and the site transport, they're covered in other documents.

Briefly, how does this work, and I think we're all pretty familiar with this. The TAD is loaded with commercial spent fuel and if the TAD is used for storage, it has to meet the conditions of 10 CFR Part 72. It is loaded from storage or from the pool into the transportation overpack and at that point, the package -- the packaging plus the contents, the entire package, complies with 10 CFR Part -- with the conditions of 10 CFR Part 71.

I want to mention at this point that if the TAD is used, it makes the points about moderator exclusion virtually moot and may even moot the question of burn-up credit. At the surface facility, at the GROA, the TAD is handled in a shielded transfer cask and transferred to a waste package for disposal or it is transferred to an -- to the aging overpack and it ages at the surface. The dimensions are from -- I apologize for the drawing. I'm not an artist even with the help of PowerPoint. The length of the TAD will be anywhere, depending on the fuel that it's loaded with, from 186 to 212 inches. The diameter is 66-1/2 inches. This plus zero, minus half an inch which also applies to the length, is that is given in the document and the shell radius is given as .25 inches. It's a right circular cylinder.

The capacity of the TAD is 21 PWR assemblies or 44 BWR assemblies. The closed TAD can be reopened in the pool. When the TAD is mounted in the waste package, there is the attempt to put in a waste package spacer to restrict any axial movement of the TAD in the waste package. The lifetime for surface aging is given as about 50 years, and the intent is not to age any fuel longer, I believe, longer than 40 to 50 years on the surface.

The maximum leak rate in the design under all conditions except for one that I'll note on the next slide, is 1.5 times 10^{12}. This is the fraction of the internal contents that can leak. And this is under all conditions, including a seismic event with the horizontal and vertical acceleration of about 3g.

The temperature limits on a load of TAD under normal conditions is 752 degrees Fahrenheit and off-normal conditions are 1,058 degrees Fahrenheit.

This is the single exception. In a fully engulfing fire of 1720 degrees Fahrenheit, a maximum leak rate is permitted or designed of 9.3 times 10^{10} about an order of magnitude more than under normal conditions. The average contact dose rate over the top of a loaded canister is not to exceed 800 millirem per hour, that's the average over -- the top is the cross-section of the cylinder. And the -- with a maximum of 1,000 millirem, one rem per hour at any point on the top of the cask.

The criticality control is during transportation, the document simply says that the requirements of 10 CFR Part 71 are met. And I assume that's whatever the requirements of 10 CFR Part 71 plus guidance are at the time that the TAD is loaded for transportation. During disposal, there is an intent to insert a .433 inch thick borated steel neutron absorber plate which will be internally mounted in the TAD.

All closures are to be helium leak tested and the document provides the -- the document provides the specifications, the specific specifications for helium leak testing. It also requires that the following materials are prohibited from being used in or with the entire TAD operation. That is no organic hydrocarbon construction materials, no pyrophoric materials are to be used in construction of the TAD and no hazardous materials which could not be disposed -- which are prohibited from land disposal under RCRA, under the Research Conservation and Recovery Act. None of these may be used in the TAD.

To go back a moment to the -- to the question of burn-up and criticality, a TAD cannister for PWR assemblies is limited to accepting fuel with less than five percent initial enrichment and less than 80 gigawatt days per MTU, per metric ton of uranium. And less than -- and must be at least five years cooled. For BWR assemblies, this is slightly different. Again, it is required to have less than five percent initial enrichment, less than 75 gigawatt days per MTU and at least five years out of reactor cooling time.

There are a number of accidents described and I put this one up just because it appealed to me. If there's a tornado, the TAD is designed with withstand the impact of these tornado propelled missiles and these are the missiles, the masses, their dimensions and the horizontal velocity in feet per second at which the tornado repels them or propels them. Under much more realistically and more probably, the leak rate is maintained under the following rainfall conditions and they give the nominal estimate for various frequencies of storms, rainstorms and the 90 percent confidence interval. Also under maximum daily snowfall of six inches, under maximum monthly snowfall of 6.6 inches and under a lightening strike with a peak current of 250 kiloamps over a period of 260 microseconds of continuous current.

I might say that living in the West, as I do, this is not out of the question at all. We had this kind of snowfall in Albuquerque over Christmas last year. The transportation overpack and they do not cite any specific certified transportation overpack in the document which is appropriate, but the cask length without the impact limiter at the end is 230 inches. The maximum cask length -- this is the maximum cask length for the largest, say 212 inch TAD. The maximum cask length with the impact limiter of 333 inches, the maximum cask diameter without the impact limiters it's 98 inches, the lid diameter 84 inches and the distance across the upper trunnions, the diameters of the impact limiter and it gives the maximum weight of a fully loaded overpack without impact limiter and 250,000 pounds and with the impact limiters and the transportation skid. So these are extremely large, heavy casks.

The aging overpack itself, these are the combined size and weight limits for the aging overpack and finally, just to follow-on on the last two. This is very similar to the last two presentations, there is a loading curve given and I would assume from the text in the document that this is in accord with the provisions of 10 CFR Part 71. And if you start with an initial enrichment of two percent and you have a burn-up going up from right out the pool to 40 gigawatt days per MTU, this is the PWR loading curve and anything in this region is acceptable. Anything in this region is unacceptable.

And a similar loading curve is given for BWR.

MR. DOBSON: This is the group that they're providing the document?

DR. WEINER: Yes.

MR. DOBSON: It's funny because, you know, in the limitations you mentioned that PWR can go up to 80, so is it a linear extrapolation? I mean, this one definitely is linear. The other one has a little more of a curvature.

DR. WEINER: This one is definitely a

linear extrapolation. That's a very good point. I would assume that this part of this curve -- these are directly from the document.

MR. DOBSON: That's okay.

DR. WEINER: I didn't make them. I would assume that is also in --

MR. DOBSON: Just draw a line from then on, I guess.

DR. WEINER: -- extrapolation and similarly, this one is very clear --

MR. DOBSON: This is definitely a line.

DR. WEINER: Yeah, the BWR loading curve starts at four percent enrichment and --

MR. DOBSON: Oh, so they cannot go over five percent, so there it becomes a straight up from there on, okay, you're right.

DR. WEINER: They're not -- they must remain under five percent.

MR. DOBSON: So then it's a line.

DR. WEINER: It's a -- it's just a straight --

MR. DOBSON: It's a vertical line.

DR. WEINER: -- vertical line here. Yeah, that's right. If you go back to the other one --

MR. DOBSON: That's it, that's it.

DR. WEINER: -- that's why, they're stopping at five percent enrichment. So this is the BWR loading.

MR. BROWN: I knew that was going to come up. We talked about that.

DR. WEINER: Say who you are for the recorder. We're on the record.

MR. BROWN: Chris Brown.

DR. WEINER: Yeah, what was your question?

MR. BROWN: We had talked about this before the meeting.

DR. WEINER: Yes, yes, this is -- it would stop right here. Finally, this is a summary of the applicable regulations that were used in developing this report. Clearly, all of the NRC parts of 10 CFR and the DOE parts of 10 CFR, 40 CFR are EPA regulations the deal with environmental impact. The appropriate DOE orders, NUREGs and standards, there's also -- I'm sorry, this should be 49 CFR 173. That's the DOT regs. And the codes and standards put out by the Association of American Railroads, the American Association of State Highway Official, ASCE and ATSM and there are also some ANS ANCI standards. And that summarizes the presentation.

There are details on all of this matter in the document itself and I really am not the appropriate person to answer questions about the document because I didn't write it.

VICE CHAIR CROFF: Any questions from the Committee? Jim?

DR. CLARKE: No, thanks.

VICE CHAIR CROFF: Bill?

DR. HINZE: A brief one; what limits the surface aging to 50 years?

DR. WEINER: I believe that -- I'm not sure what limits it. I believe the text suggests that the limit is a conservative suggestion of how the aging overpack will withstand whatever happens to it when it sits outside and it is a conservative measure. But in the Environmental Impact Statement, the FEIS for Yucca Mountain, as I recall, the proposal was that aging be for 40 years, for a maximum of 40 years. So they've added 50 years to it. I believe it's combination of those two. There's no particular rationale given for this number.

VICE CHAIR CROFF: Committee staff?

MR. BROWN: I just wanted to -- Chris Brown. I just wanted to note, I think we have some folks from Chris Good's staff back there. They may want to just --

DR. WEINER: Yeah, do you want to add anything to --

MR. BROWN: No one? That's fine.

DR. WEINER: Okay.

VICE CHAIR CROFF: Okay, thank you, Ruth for that summary. Let's move on to the next talk from Robert Grubb from Areva. Come on up and get set up and with that, I'll turn the gavel over to our cognizant member for this session. Ruth.

DR. WEINER: Okay, thank you.

MR. GRUBB: Thank you. We requested an opportunity to speak to you. Mr. Kouts spoke to you on June 18th and I understand that you're making a recommendation or maybe potentially taking some recommendations to the NRC and we wanted to get out two cents in. We can't speak for all vendors, so when we talk about vendors' views, we're primarily talking about Areva Transnuclear. We're not talking about the rest of the world.

Although we have incorporated some of the information from the NEI conference. There was a panel that occurred there where all of the vendors commented on the TAD specification and so we've incorporated a little bit of that information. I'll try to go very quickly so that you can make it to lunch and we'll take it from there. Let's see, how to work this thing.

Again, my name is Bob Grubb. I'm Senior Vice President of Transnuclear and we're in the business of storing fuel. Overview, we're not going to pop up a slide each time to tall you what the overview here is but the flow of the discussion here, we're going to walk through a little bit on the proof of concept for the TAD which Ms. Weiner did a very good job of walking through this. We'll talk a little bit about the TAD performance specification, not a whole lot. Then we're going to talk about the technical and schedule challenges that we see in trying to get this licensed and trying to get this through the system and trying to get the technical work done and a few suggestions for expediting through the NRC approval cycle. Nothing drastic. Most of what we've heard back from the NRC already, a few observations on our part and then we'll open it up to any discussion. But, please, I mean, obviously, interrupt me any time you want to ask a question.

The proof of concept, as Ms. Weiner said, we've got a canister, we've got an aging overpack that looks a little bit like what you see here and we've got a transport cask and that's the MP-187 as a matter of fact. You're going to actually have two canisters. You're going to have a 21 assembly canister and a 44 assembly canister. You will have at least one transport cask and you will have at least one aging overpack.

Transnuclear was one of four vendors who were contracted to develop a TAD proof of concept. The TN TAD system design is based on the existing NUHOMS and metal technologies. There are a significant number of those that are already out in storage in the industry right now. The aging storage is stated to be above ground, either vertically or horizontally. Our system will be able to be operated above ground either horizontally or vertically.

Disposal is in the horizontal orientation and basically the design as it's stated, accommodates all the US PWR and BWR commercial fuel with the exception of South Texas class fuel, which is too long. The details of the design from our perspective our currently proprietary. There is a non-proprietary version that the DOE has. Our assessment of the proof of concept, and I think this is pretty generic among the spent fuel cask vendors, as was discussed at NEI, I think in general, I think we believe that DOE has done a great job of managing the TAD development.

They got early involvement of the stakeholders and we believe that that was very effective. They asked some of the right questions, got some of the right answers and they got rid of some of the preliminary unrealistic requirements. And they were eliminated even before the proof of concept spec came out.

TN, and I'm sure the other vendors, are going to fully support DOE with the TAD systems designs. The proof of concept project has demonstrated and I think for all the vendors, not just TN, but they've definitely demonstrated that TN's design will meet the DOE specification at least the say it was written for the proof of concept.

TN has begun discussions with the current utility customers. We've gone around and we've polled a few of the customers. They are fully on board, willingness-wise, to participate subject to whatever incentives the DOE is going to come up with and what the requirements for them are going to be because when they do this proof load, that fuel has to be stored on their site in an overpack for a long time. Okay.

The final TAD specification addressed some of the proof of concept technical concerns because we did feed those back to the DOE as part of our submittals. We submitted a compliant design and in addition, we made recommendations. Some of the concerns that were addressed in the final specification that weren't in the initial was the length of the canister. At first it was specified as a fixed length. Now it's a variable length. That will help in the long run.

Integral lifting trunnions, originally there were integral lifting trunnions and now they're allowed to remove the upper trunnions and the bottom trunnions are fixed. There's also an integral lifting device and I just flipped the bullets there. My eyesight is not as good as it used to be at this distance, but we -- at first the lifting device was to be rigidly attached or permanently fixed on the top of the canister. And now it can be removed. Those were all recommendations from industry.

Maximum burn-up, the TAD spec came out with 75,000 and 80,000. We took that to mean like we would from a commercial utility that our designs had to be good to 80,000 burn-up and to 75,000 burn-up. Seeing as how that would be very high burn-up for what's currently in the industry, we thought that was going to be very difficult to license. Since then it is said below 75 and what you saw on the chart that came out with the spec now is five percent, 45,000, which is certainly within what's currently licensable.

The design transportation overpack for maximum TAD canister weight, originally it was to be only the maximum TAD canister weight for the transport overpack and now you can have less than the maximum weight in the transport overpack. The TAD canister can weigh less than 54.25 tons which allows you potentially the long-term, do higher heat load or higher burn-up fuels. DOE has continued to address some issues and however, even with what has happened, there are some issues and recommendations that we made comment on, at least TN did that didn't get addressed.

We put our recommendations into a couple of categories. One, we had several recommendations associated with changes to make the TAD more widely deployable at utility sites and aging facilities, and the aging facility. Primarily, what's left that didn't get incorporated from our recommendations are increase capacity for both PWR and BWR canisters. The industry kind of started off with seven PWR fuel assemblies to be stored, went to 21 to 24, is now at 32 and going to 37. To go back to 21 is difficult in the per-assembly cost for any particular utility.

The BWR canisters, I think they were down in eight and then 52 and then were at 61 and 68 and going up to 72, 89. And the utilities are looking for more fuel, not less and it's directly related to per-assembly cost. Even if you look at it, it's also a space concern because if you're at 44 instead of 88, obviously, it's going to take you quite a bit more space. Your ISFSI has to be larger which is increased cost. For excavation, it's increased cost, for the pad concrete, it's increased of land that you've got to deal with. It's expanding your protected area. All of those costs have to be factored in when you have to do this on an ISFSI. Reduce total dose, again, the less often you have to move it, the less dose you're going to have because the systems themselves are pretty mundane when you put them out on the pad. It's the transferring from the fuel building to the pad is where the dose is.

Reduced number of transport shipments, you could double the number of transport shipments by keeping at 21 and 44. Reduce the ISFSI age and overpack footprints, we just talked about that, and again, reduce the number of disposal transfers because you've got it out on the aging overpack. Now, you're got double the number of disposal from the aging overpack into the final resting place. And potentially there's reduced space required for the final disposal facility.

Recognize it may not be doable for Yucca Mountain. We don't know but technically, if it can be done, it really ought to be done because there's an extreme cost associated with that.

DR. HINZE: What about the thermal aspect of that?

MR. GRUBB: That's what would have to happen and I think what you'll see a little later on is our recommendation is somebody ought to look at the thermal inside the mountain so that you can ship higher heat loads and you can ship higher dose rates on the aging overpack so that you can put more fuel assemblies into the mountain because it's pretty much driven by thermal. It's pretty much driven by heat and if you're really limited by heat in the mountain, maybe you're limited by 21, 44, I don't know, but that's the controlling factor.

Changes to ease operations at the repository and reduce cost, allow higher dose rates at the aging overpack vents, this is just directly -- you asked the question at the right time. Basically, if you allowed the dose rates to go higher, you could have higher heat loads and you could ship hotter fuel, you could ship more assemblies, you could do all those things that would be nice to do from a cost perspective.

Again, when you get it in the mountain, maybe that has to sit on the aging overpack pad for 60 years or 70 years instead of 50 years. I mean, I don't know. You'd have to do those to find out what that does. At any rate, the way it's designed right now, or the way the spec calls out is right now, they're saying, and I'm pioneering at little bit here. Right now, they're calling out in the spec that it's pretty much expected that it's going to say on an ISFSI site for 60 years, of which right now our Part 72 licenses are for 20 years with the potential for an extension. So we're looking at an extension of 40 years on the Part 72 license in order to be able to meet that requirement and then you've got another 50 years on the pad, so you're talking about a canister that has to be designed to meet the environmental constraints for 110 years by this specification, just to point that one out.

I think that it would be worthwhile to allow, and this is one of our recommendations, and I recognize we build horizontal storage systems and we're the only ones that build horizontal storage systems, and -- but the way it's been addressed to us from DOE is that the horizontal storage system is allowed but not this time. It's allowed to be brought in as an amendment after this gets approved. Well, this being approved and demonstrated is going to be some time in 2012 through 2015 and by 2015 then I can put an amendment in, it doesn't feel good to me for something that I believe is the better system.

But anyway, NUHOMS horizontal storage modules have been shown to meet the objective. I mean, the horizontal storage module, we're talking about 3g loads here and we have modules that are designed already and licensed to take 1.5 g in each direction and one vertical, which you can't do really very well with a metal cask. We do both, metal cask and horizontal storage modules and it will take -- meet the aircraft impact objectives. There aren't any critical lists of the canister to and from the horizontal overpack, aging overpack if it's already horizontal.

Ease of operations and handling, it does spread out the pad loads and decreases the cost. No need to handle the loaded aging overpack. Right now you have to pick it up and carry it out to where you're going to put it and set it down, this massive concrete structure with the canister in it. The massive concrete structure, in our case, would be on the pad in a horizontal case and the canister would be just inserted into the horizontal structure and you wouldn't have the three-foot drop that you now have based on carrying it out. You have to analyze for a three-foot drop and it would allow a higher heat load, because right now our modules are qualified for 40.8 kilowatts and you could ship it all out there and let it heat out there instead of at the utility.

Many NUHOM systems with horizontal orientation are already licensed. As a matter of fact, there's 300 to 400 of them already loaded out here in the industry. So but right now, we will propose on a vertical system. That's what the spec says. Significant constraints outside current requirements, these -- to some degree some of these are additional constraints that are new in this spec. Some of them are comments that we made that didn't get addressed previously. The requirement for bow rated stainless steel, Ms. Weiner talked about that, that would be fine if we could use the stainless steel for structure. If the DOE or somebody would go ahead and run the ASME code case through and get it allowed for structural credit, that would simplify the design and make is less expensive.

The bare TAD canister, one-foot drop, basically the one-foot drop, at least in our case, I don't know about the rest of the vendors, requires us to have an impact limiter on each TAD canister. And my understanding of the one-foot drop is that it's inside the disposal facility or inside the handling facility and it seems to me like there's a possibility you could design one, install one and save buying all these impact limiters for all these other TAD canisters that you're hauling out there, which would also shorten the transport cask by the height of the impact limiter which would mean that we could increase the diameter of the shielding on the transport cask which would make it more ALARA in transporting it across the country. It does complicate the design. It does make it require longer transport overpack. It also requires a longer aging overpack because this impact limiter, according to spec, has to be included with the canister before you transport. So if we didn't have to include that in the forward -- even if we could hook it on when we got it there, it would save money, it would save time, and it would save dose.

Seismic qualification, the canister transport overpack has to sustain a 10-foot drop onto an unyielding surface without impact limiters and that's a new one for pretty much everybody. That's not one of those Part 71/Part 72 requirements. That's okay, we'll find a way to meet that. Canister aging overpack needs to remain upright and free-standing for 2,000 year, 10,000 year and 3g. And I'd like to defray conversation on that and we'll talk about that in just a minute.

The next one is kind of out of the specs, is the 1720 fire. Currently we analyze, I think, 1475. This is 245 degrees hotter than what Part 71 requires. We can meet it. It's easy enough to meet it. It's going to be something new to give to the NRC when they finally review the fire. That's just the way it is. 10 CRF Part 71 requirements should be adequate because it's not going to change the outcome whether you go to 1720 or 1475.

Recent TAD specification changes do create some technical challenges. In Transnuclear's opinion and I'm sure that all the cask vendors don't agree because some of them are designed this way, trunnion location and design, in our opinion, should be defined by the designer with the limitations specified for the disposal facility and allow the designer to use existing impact limiter designs and test results if possible. There's a possibility that we may have to go out and we may have to do a full-scale drop test. We may have to do a prototype drop test or we may be able to justify that the drop test that's already done is adequate.

That's an expense. That's a new design for some people. We believe the designer should be responsible for designing the interfacing to the skid. DOE should obviously design the interface between the skid and the rail car and DOE should obviously, design anything that has to interface with the disposal facility or the aging facility. Enough said on that topic.

Seismic 3g, this represents an increase in requirements and may require different new methodologies not previously reviewed and approved by the NRC for this application. And I think it will require some new methodology, some new designs. You have to consider, the aging overpack is to be freestanding. That's a requirement. The aging overpack is to have no anchorage. That's a requirement. The aging overpack is to be on a flat pad so you can't sink it down in the pad to help make it stable, and it has to remain upright during and after a 3g earthquake. In my experience, anything with an aspect ratio of too high over one diameter, you really have to do something. You either have to tie it down, you have to tie it to something else that's going to move with it, or you've got to get out of the way. I mean, this is just not that easy to do.

There are some designs that could probably be dreamed up that would work but they're not going to be that easy to analyze, they're not going to be that easy to find acceptable when they get reviewed. I mean, two that come to mind right off the top is just to give you a visual image and I don't mean to, you know, be flippant about this, but an outrigger design. If you vision an outrigger, that's a possibility that meets all of the criteria. The other one, for anybody that's ever played air hockey, that one meets all the criteria but I don't think we'd want to be out there dealing with those kind of designs. I think we ought to try to keep it simple and specify it correctly so that we tie it down or tie them together or do something that makes it simple to make this operate.

I'm not saying it can't be done. It appears that the solution in the spec is somehow tied to the addition of about 50 to 100,000 pounds to the aging overpack weight. I mean, that's fine and that can lower the CG somewhat but you're still restricted in a geometry arrangement so you still -- maybe you don't have a 2/1 but you still got a 1.8 or a 1.7/1 aspect ratio and in my experience anyway, it's going to fall over at 3gs without some kind of assist or some kind of a fancy arrangement that's going to be difficult to design.

We will do it, okay. We will do it and we will give you a design but my recommendation is keep it simple and figure out a way to tie it down. And it will increase the cost of each aging overpack because you're going to add 50,000 to 100,000 pounds worth of concrete and you're going to have to do something different than what's there now and it's also going to increase the cost of the basemat because you're going to have to increase the thickness of the basemat to take the additional load on every single aging overpack.

Schedule challenges, there's a lot of final design work. We do this all the time. This is what we do for a living. There's a lot of final design work to be performed in a short period of time. We're talking about a submittal -- I mean, right now the request for proposal is out. We submit at the end of August. The DOE right now has 180 days to review and approve it and they're wanting to submit a SAR and we'll talk about what that means, by some time around August of next year. Okay, that's aggressive when you think about what has to be done because what has to be done is we have to design a transportation overpack for a PWR and a BWR TAD canisters as payloads. We have to design a storage overpack with PWR and BWR TAD canisters at payloads that's adequate to meet Part 72 requirements on a given utility. We have to design an aging overpack with PWR and BWR TAD canisters as payloads. We potentially have to design some new ancillary equipment, in one location or another, don't know where exactly at this point till we get deep in the design and then we have to design the TAD canister itself for both a PWR and a BWR. That's a lot of design work, final calculations, final design, just pulling together the design reviews and inordinate amount of work between now and June or August of next year.

There's also a lot of licensing preparation and can we do it? Yeah, we can throw enough money at it and we can do it. 10 CFR Part 72 applications, probably Part 72 applications are not going to be really applicable. If you're going to get a utility involved that's already using a current license, my guess, it's only a guess, is that they're going to want to amend their existing license, not carry two licenses forward into the future for what they're already doing. So you're going to amend a license for Part 72 most likely at whatever utility is going to play with you to go in and do this. Okay.

For Part 71 applications, you're going to need a brand new application for Part 71. And it's just a typical Part 71 application. The DOE Aging and Overpack Safety Analysis Report, all we have to do is generate a safety analysis report and submit it to the DOE. It's still going to have to have pretty much everything that a new application is going to have to have for the NRC.

General concerns and recommendations; and I'll get back to the outcome of what I just talked about here in just a second. DOE needs to be encouraged to improve the design basis at Yucca Mountain to increase the capacity of the TAD canisters. Again, it goes back to the heat load that was brought up earlier. You need a bigger heat load at Yucca Mountain if you're going to keep up with the industry because the industry's already passed that level. They're way past it.

Incentives need to be developed quickly to encourage utilities to switch to the TAD system since they will be less cost effective for utilities than currently licensed storage and transport systems. I mean, you're talking about per assembly cost. After it's designed, after the modules are designed the TAD canister may be some amount more expensive or less expensive, it really isn't going to matter. What's really going to matter is per assembly cost. And when you're talking about 21 versus 37, there's a lot of per assembly cost built in there and the utility is going to need a lot of incentive to make that jump, to make that leap.

The focus on TAD application review could slow down the NRC review time on other critical storage and transport applications and let's just talk about that a little bit here. TN suggestions for expediting the NRC approval, within Part 72 and Part 71 I don't how you can do a whole lot of expediting. If the NRC just flat meets the schedules that they usually meet, we're still out in 2012, 2015 and that's by the existing groundrules. Time is critical. What Mr. Kouts said is 2010 to 2012 we'd have a demo. Okay, I'm having trouble figuring out how the paper is going to get done before 2012 at this point with the schedule we've got.

But the way to truly make it go through

the first time is as the NRC has told us over and over and over again, one RAI. Don't ever go for the second one. Make it good enough to make one RAI. Okay, so the idea would be to engage the NRC early. If we're going to submit in August, we should be engaging the NRC certainly no later than January. Engage about the submittal content, the methods, any variation from previously approved submittals, get to the NRC early.

Use proven technology and methods that are previously reviewed and approved by the NRC. For the most part, we can do TAD with previously approved methodologies. I don't know what we're going to do with seismic yet. We'll figure out something. It's not going to be previously approved. I can almost guarantee it's not going to be previously approved. And how we handle impact limiters and how we handle a few of the other details may or may not be previously approved.

Apply existing regulations as closely as possible. I mean, don't go beyond, don't take the Part 71 to 425 degrees higher. You know, don't add things to the canister that aren't required that the NRC really doesn't require under Part 71/Part 72 now. My view would be that Part 71 and Part 72 are good just like they are. Avoid new and contentious regulatory issues for the initial submittals. Again, I guess I would put the 3g in that category and until we got relief back down to 45,000 burn-up, I would have put 75 and 80,000 burn-up in that category because I think there's no fast review process that's going to get that through. The data just doesn't exist at those levels.

Allow sufficient time to prepare the submittal which is really tight right now to prepare the submittal because the quality of the submittal in our experience directly effects the NRC review time. If you get a really good high quality submittal the review goes fairly quickly. If the NRC has to stumble over editorials, chapters out of place, whatever it is that turns out to be -- missed a table out of these 1100 pages you submitted to them, it's -- it takes a lot longer. And so it has to be a quality submittal.

And keep in mind that we're putting together four or three quality submittals; actually two canisters, an aging overpack, storage and transport. Use well-established materials in the design with sufficient well-accepted supporting data and I think for the most part, we are except an ASME code case for structural for bore rated stainless would be a really good benefit.

TN observations for going forward, incentives need to be established and you need to engage the utility people right now, maybe a month or so ago because there's just not enough time. I mean, there just isn't enough time in the schedule to be able to submit a utility partner going in without having the incentives already established right now to go out and start talking and find them. And I mean, we'll try, we'll do everything we can to get a utility involved but those incentives need to be established.

Engage potential suppliers, when everybody goes out to get bore rated stainless steel I mean, just by me saying that the price probably went up. Fabricate TAD canister prototypes early, the sooner we build one, the better off we're going to be. Success requires timely DOE reviews. I mean, it really has to be either in line or it's got to be right now. You can't take any time to review it. There's just not enough time in this schedule to make that happen, okay, to get it done.

TAD likely will slow down the NRC review time on critical storage applications. A number of utilities are up against full core offload. Currently there are 13 storage applications, at least that's my count, unless something happened yesterday, I don't know. But 13 application amendments and review process. There are five transport applications and revisions in the review process. Our plan is to submit three more storage and four transportation submittals within this window that we're talking about over the next year and a half to two years. And on top of that, the other vendors are going to do the same thing. So I think the NRC is, be definition, overloaded at this point in my opinion from what I see. I'm just throwing that out there and maybe there's something I don't know about. There's this cadre of qualified people that are sitting in a room and are just waiting to jump on this, but I don't see it right this second.

TAD operation by 2012, I think it is possible. I mean, with the right priorities, if we set the right priorities, we do the right things, we jump on them in a hurry, and we get one set of RAIs and we get the submittals right, I think it's a real uphill battle. I think it's aggressive. I think some time between 2012, 2015 we might have a TAD but 2012, we'll work for it. We'll do the best we can. That's my presentation.

DR. WEINER: Thank you very much for the very good discussion. Bill, question?

DR. HINZE: Mr. Grubb, what's the good news?

(Laughter)

MR. GRUBB: I guess the good news is that the spec does work, I mean, except for the last couple of things, we are going to be able to design something that's fairly inexpensive that will work and if we go in for phase number one and we get 21 and 44, I think you could probably get a utility on board to say, "Yeah, we're willing to do 21 or 44 for the TAD canisters up front", and then I think in the long run, if you do a phase submittal, I think you move it up, but that means you've got to start working, I think, now to get the thermal properties inside the mountain. I mean, or you're going to have to plan on storing it longer on site at the aging overpack. You're going to have to be there for a long time. But somehow there's got to be a way to get the per assembly cost down. It's very high for 21.

DR. HINZE: I understand the amount of waste you can put in the containers from the thermal load standpoint but this vertical versus horizontal, the DOE must have a very good reason for going with the vertical canister. What are the advantages that you could see for a vertical canister that they're asking you to bid on?

MR. GRUBB: Well, our primary business is horizontal, even though we do vertical metal casks, and I think you'd probably want to ask one of the other vendors what the advantages are.

(Laughter)

DR. HINZE: Do you see any advantage at all to the vertical?

MR. GRUBB: Personally?

DR. HINZE: Yeah.

MR. GRUBB: With what I know about our NUHOM system --

DR. HINZE: I mean, with how we constructed them.

MR. GRUBB: I think there potentially are some advantages. There's certainly some advantages if you've already built your disposal facility and you've got your crane set up and everything is set up to trolley this in, in the vertical condition. Frankly, I don't see a whole lot of advantages in this case to having it stored out on the aging overpack in a vertical direction. I mean, my personal opinion. I'm not sure I'm going to speak specifically for TN as an officer. Right now I don't see it. I think you'd have to ask our competition.

MR. GRUBB: I asked Dr. Weiner about the 50-year limit in surface aging. If I understand you correctly, that needs to be bumped up some. Is there any problem there?

MR. GRUBB: I don't think there's a real problem depending on how you do it. I think that the steels that we're talking about, you're talking about whether the environmental --

DR. HINZE: Right, right.

MR. GRUBB: And I think the environment will. I think what we're talking about, the kind of canisters we're talking about, the quality of the fabrication, I think the 316L type stainless canisters are good for 100 years, 110 easily.

DR. HINZE: Are there tests that show that? You know, what I'm trying to get at, where does this 50 and upper come, out of the air someplace?

MR. GRUBB: I think -- you mean, as far as why are we going 50 years?

DR. HINZE: Right, no, what limits it to 50 years?

MR. GRUBB: I think it's primarily thermal. That's my guess. I mean, I'm not the DOE. I haven't really kept up that much with what Yucca Mountain is calculating but I would guess that it's thermal.

DR. HINZE: Thank you.

DR. WEINER: Allen?

VICE CHAIR CROFF: A couple of things; on the burn-up and getting it lowered, I'm -- and noting that there's a fair amount of fuel going to be coming out at higher burn-ups as the utilities go up, is the implication of this we're going to see a living specification or a series of specifications into the future for, you know, different generations of TADs as this happens and these limits are hit?

MR. GRUBB: Personally, I think it's inevitable. I mean, I think at some point you're going to get the fuel off the reactor site. There are sites right now that I don't think have any fuel that can be taken out of the pool that can go to TAD directly. There are sites that have burn-ups right now that are higher than the 45 and that if you're going to put them in TADs, you're going to have to leave them on their site until you figure out what to do with burn-ups higher than 45.

Current transport cask for -- under the current regulations without things like fins (phonetic) and all the other stuff, you're looking at 13, 15, 16, maybe 18 kilowatts. If you want to go higher, like they do in Europe to 30 or 40 kilowatts to transport it out, I mean, and we've got hot fuel coming out. We've got hot fuel coming out. A lot of people are already up against the five-year cooled limit. They barely have fuel that's five-year cooled any more and they have to get it out because the pool is full. So, yeah, I think it's got to migrate.

VICE CHAIR CROFF: Okay.

MR. GRUBB: Whether it's going to be soon or not, I don't know.

VICE CHAIR CROFF: Second, you noted in a number of places what I'll call, where the specification had what I'll call beyond regulatory requirements, the higher fire temperature and there were a number of those. Is this basically going to lead you to have to prepare let me call it two cases, if you will, a licensing application against 71 and 72 and then a different document to show DOE that their specification is made?

MR. GRUBB: I don't think so. I think what we'd end up doing is just simply saying we met the specification, we ran down the analysis. I mean, obviously, if it works for 3gs it will work for 2 gs, it will work for 1 g and so forth. If it works for 1750 it will work for 1475. So, no, I don't think we're going to have to -- we'll still do a bounding analysis, it's just it make the analysis differently, something the NRC hasn't seen before.

VICE CHAIR CROFF: Okay, thanks.

MR. GRUBB: Thermal models may be different, load applications.

DR. WEINER: Jim?

DR. CLARKE: I guess this is a follow-up to what Allen just asked; you've listed a number of areas where you would like to see revisions and you've given, I think, awfully good reasons for those revisions. Is that ongoing now in the midst of a schedule that's already very ambitious? Are you negotiating revisions and all of that?

MR. GRUBB: Well, our questions on the RFP will probably be made public -- I mean, I assume they'll be made public since this is a DOE RFP. So I think some of these questions come out in that. And I don't know whether the other vendors are going to submit questions or not. Typically, in a RFP you don't want to give away your hand, so you try not to submit too many questions. But hopefully, we're being open and direct and we're not trying to pull any punches here. I mean, it's kind of a little bit the way at least I see the world and I think TN partially for the most part sees the world.

DR. CLARKE: Thanks.

DR. WEINER: Thank you for making the point about the impact limiters on the TAD. And leading from that, what kind of a drop do you think the TAD could sustain inside the overpack if you didn't have the impact limiters?

MR. GRUBB: I'd be hard-pressed to say. I mean, we do an 80-inch drop on our transfer cask and we survive an 80-inch drop just fine without damaging the fuel for our current cask. So I'm guessing 80 inches would probably be okay. Ten feet, that's a little bit different. And the configuration that you put it in, what it's in. If you take a bare cask and you try to drop it, it's -- or a bare canister and try to drop it, it's a little bit more difficult to put it inside a cask. We'd have to analyze it and find out. The point being that it's just an analysis that we don't do. I mean, we can do it. It's one that right now we don't submit to the NRC. It's going to be a new load condition. It's going to be a new condition that has to have all the stress reports and all the pieces and factored in with all the bounding conditions. It's takes more time. It takes more time for the NRC to review it.

DR. WEINER: My other question is -- goes back a little bit in size. There are some plants that don't have rail access, direct rail access. Are there -- do you know of any plans to construct TAD type canister that can be transported on a truck, an overweight truck?

MR. GRUBB: I think what you've got now proposed will go on a truck. I mean, you can get a 12-axle truck, trailer, put a skid on it, spread the load. Most sites will be able with minimum amount of cases to probably go on and be able to use that kind of a truck transport out to the rail head somewhere and then now under IAEA, you're going to have to then qualify the skid, what a lead skid is and to go with the cask, under the new rules, to pick it up and put it on the train and so forth, but I think it could be done right now. I don't think it's out of the question.

DR. WEINER: Do you have questions? Audience, comments, questions from anyone? Well, hearing none, thank you very much for a very thorough and thought provoking presentation and I'll turn it over back to the Chair.

VICE CHAIR CROFF: Thanks very much. And with that, we're adjourned until 1:30, where we'll pick up a different subject.

(Whereupon at 11:57 a.m. a luncheon recess was taken.)

CHAIR RYAN: Folks, if I can ask you to take your seats, please, we will come to order. Let's see we have a good solid afternoon ahead of us and a cognizant member for this session on the ACNW's White Paper on Spent Nuclear Fuel and Recycle Facilities is Allen Croff, Vice Chair. Allen, take it away.

VICE CHAIR CROFF: Thank you, Mike. This afternoon's session concerns our continuing efforts to keep informed on spent nuclear fuel recycle. We're going to have two parts in this. First, we're going to hear another in a series of background briefings from the fuel recycling industry with today's presentation being from EnergySolutions. Then after a break we'll reorganize and focus on the Committee's draft White Paper on Spent Nuclear Fuel Cycle by way of two briefings and then a roundtable discussion. And I'll elaborate on how that works after the break so as not to complicate matters.

At this point, I'm please to introduce Colin Boardman, who is Vice President of EnergySolutions' Nuclear Energy and Fuel Cycle Group and Alan Dobson, who is Senior Vice President of

EnergySolutions' Fuel Cycle and Spent Fuel Management. Colin, I understand you're going to start, so please go.

MR. BOARDMAN: First of all I'd like to say, thanks to the Committee for this opportunity to provide information to consideration of fuel recycle which is an issue that we believe is really important for energy generation, nuclear energy generation for the USA. This presentation is actually a shortened version of a much larger presentation that we did provide to ACNW. To the extent it's possible, we'd encourage you after the meeting in the coming weeks to review the complete set of information. It does contain a lot more information in detail about the company and what we're proposing and also a lot more context about the technologies and the approaches we're going to take.

CHAIR RYAN: Colin, I might add just quickly that we will add that material as a permanent part of our record of the meeting as well.

MR. BOARDMAN: Thank you. We appreciate that. The quick overview I'm going to talk to you today, as I say, is a little bit about who the company is. We're a fairly new company. Alan is then going to talk to some degree about our approach to used fuel recycle, constrained by proprietary matters, unfortunately, but that's the way of the competitive world these days.

We're also going to talk to you on what we believe is a very important issue for the topic of recycle which is waste and effluent management, both in terms of waste streams that will need disposition and in terms of discharges. So it's very likely on fuel cycle facilities and more importantly how the lessons we've learned will play into the design of next generation facilities and some of the lessons learned associated with that.

So to start, who is EnergySolutions? Very new company, it's been in existence for around about two years. Essentially, grown out of six or seven acquisitions starting with EnviroCare of Utah. I think more importantly, I'd focus on one acquisition of a company called BNG America, a wholly owned subsidiary of the BNFL in the UK because through the acquisition, came all of the technology, recycle, waste management and back end technologies that EnergySolutions now has and just as importantly, over 100 senior design engineering and operation staff with the capabilities and experience of applying those technologies.

There's over 5,000 employees in the company today. We operate in 40 states in the US and also overseas, in particular in the UK right now. About 60 percent of our business is with the US Government or government clients, I should say, and about 40 percent with commercial utilities. We're a purely nuclear company. We do not engage in business outside of the nuclear industry.

We are an owner/operator which gives us particularly sharp insights into the business of operating design and building and operating nuclear facilities. And we have, as I mentioned, through the acquisition of people and technology, the complete suite of technologies necessary to deploy modern day recycle through spent fuel management. Essentially, our goal is to become the premier US fuel cycle company.

The next slide is just really a pictorial of that simple overview from uranium mining through to disposal of the fuel cycle industry. We actually started at the back end of the disposal end and as our EnergySolutions swooshed, we're now across from disposal, waste management, reprocessing spent fuel into reactor operations. We have reactor operations in the UK now. We're not yet into fuel manufacture but we are in discussions about that, similarly with enrichment in uranium mining. So this is really a picture of where we are and where we'd like to be.

Core capabilities, we specialize in high-consequence nuclear operations. We discuss each of these areas in more detail in the larger presentation which you will receive. Effectively, we specialize in high-consequence nuclear operations, bespoke technical solutions to complex nuclear challenges including difficult cleanup work and D & D and in particular waste management transportation logistics and the whole range of low-level mixed Class A, B and C waste disposal.

At this point, I'd like to hand off to Alan for some more detailed coverage of safety and actually what we think about reprocessing and recycled fuel.

MR. DOBSON: At EnergySolutions safety is paramount and that statement would surprise nobody. And I just want to try and give a flavor about EnergySolutions' approaches at managing safety and improving safety performance. There are three essential ingredients; committed managers who make sure that resources are available. They provide leadership. They need to establish safety management systems and engagement and empowerment of employees is the other essential ingredient. And I would just make an observation, from our experience you can have the best safety management systems in the world. If either of the other two are missing, then you will not get satisfactory safety performance.

And all operators of nuclear licensed facilities are required to establish safety bases or authorization bases which are reflected in the particular licenses and permissions to operate, permissions to construct, et cetera and we're no exception. And in terms of safety performance, we regard safety as just another aspect of business performance and like most companies in the business, we measure a number of things. We measure events and incidents and I'm pleased to report that the frequencies although of events, they're not zero but the severity is very low. We have industry leading OSHA accident rates, I didn't put any numbers up there and if I were to use a 12-month rolling average, as opposed to a 12-month start afresh each year, a 12-month rolling average. Our recordable rate is .67 and our daily case rate is .13.

The goal is zero and I'm pleased to be able to report that many of the businesses are actually achieving zero and sustaining it. And so, for instance, at several of our facilities that operate waste disposal operations and has mandated to achieve zero lost time accidents and to be sustaining that record for several months or even years in one case. And as I say, the goal is zero.

With regard to workforce exposure or exposure of the public or anybody, you clearly need to be operating below authorized limits and again, it does vary from site to site depending on the nature of the operations and quite frankly, depending on the nature and culture of the organization that formerly existed before the EnergySolutions' acquisition. But I can say that overall the radiation doses are reduced to as low as reasonably achievable and substantially below authorized limits in any case. And all business managers are required to improve performance from year to year and safety is just one of the areas in which specific is tied second, it varies from business to business.

But a point I want to emphasize, the last two points I would emphasize, we believe the only way you can do that is by empowering employees to find a business solution and the chief executive actually and his executive team, sets the standard. And in one particular example, a recent example that was involving handling contact waste, it was very clear that a significant dose uptake was arising and we needed to reduce that. An employee improvement team found the solution and were empowered -- they didn't have to request the results. They were empowered to actually requisition and purchase the results, and that's an essential feature of employee empowerment. And I'm please to say that through that working smarter with the additional resources, the dose uptake in that particular operation has been reduced by a factor of 10.

And here's where we get, I guess, to the UK connection and the technology, the reprocessing technology that EnergySolutions owns relates to Sellafield in the United Kingdom. Sellafield was staffed as a defense based facility and its mission was to reprocess material from reactors whose sole purpose was to produce material for the UK weapons program. And there are two commercial reprocessing facilities operating on that site today. Over 60,000 tons of material have been reprocessed in about the last almost 50 years, a little bit more than 50 years.

And actually, I quoted the wrong figure. There's been over 60,000 tons of material transported but it's just over 56,000 has been reprocessed. I just want to focus on some of the innovations and I would say first and foremost, my view of innovation is not the same as invention. Innovation, it doesn't matter who invents something, provided they're not protected by a patent, whatever, but innovation is about bringing that invention into commercial use. And so some innovations that are very relevant to what we want to talk about with regard to reprocessing and salt free flowsheets and technetium removal and dissolve off gas cleanup. They're all very relevant and if I just swell on the technetium removal, and something that I read in I think it was this paper, that you're going to discuss today.

Certainly, when we were developing the flowsheet for the third generation facility, we were surprised to find that technetium behaved differently to what had been expected. Now, we didn't find that surprise on the facility. We found that surprise on one of the test facilities and it was traced to the performance of technetium and the significance of zirconium in the separation. But we were able to develop and control the chemistry and that's very relevant to what I'm going to talk about in terms of advanced processes. We were able to control the chemistry to effect the technetium removal and anybody who understands the chemistry of reprocessing will understand the difficulty of controlling valences, when you're trying to oxidize one to a certain state or reduce one to a certain state, such that we didn't need a separate cycle for technetium removal. And that's very relevant to considerations for GNEP, not so much the technetium but the fact that an appropriately scaled hot integrated facility was used to test the flowsheet and that is an absolutely essential next step in consideration of whatever flowsheet might be used for GNEP.

And it's a perfect example of how surprises can reach or can grab you. In terms of equipment innovation, we use no moving part cells wherever we can. I'll talk a bit more about those in a moment. Power fluidics essentially on the pins, a lot of the technology for enabling maintenance free, no moving parts. So we used power fluids for movement of both liquids and gasses and controlling processes.

And auto-sampling, in the third generation facility, the auto-sampling systems enable the laboratories to be directly integrated with the process and the laboratories actually control process sampling, not the facility operator. And, of course, for that to be effective, it has to be fully integrated. But auto-sampling, for instance, is just a way of getting that done. And there are several examples. If we're going to build new facilities in the United States, they're going to be substantial, they're going to be shielding and down the years we've developed techniques. Now, if you're just pouring concrete into a plain old wall, that's relatively straightforward, notwithstanding reinforcement for seismic considerations. But if those shield walls, for instance, have got significant penetrations and depending on the seismic, that makes it more difficult. When you throw a requirement for reinforcing into that mix, it makes it quite a difficult task. When I say difficult, it can be done. This is all about making it easier to do and therefore, quicker and therefore, reducing the cost of construction, which I think is going to be a very significant factor in the big picture mix down the road.

We're going to talk a little bit later about environmental performance, but I have noticed that our original presentation is a little bit less than we wanted to envisage and certainly what I'd like to say up front is that the base for operation of the

Sellafield site was based on discharges to sea. It sits on the Irish Sea and it was based on discharges to the Irish Sea. And over the past 50 odd years the site has operated under authorized limits and certainly in the time that I've worked there and I'm pretty sure before that the authorized limits have never been reached but it is a fact that in the 1970s the discharges particularly of alpha material, reached about 65 percent of the authorized limit for the site and the company that was operating the site at the time knew that it would be bringing on line new facilities, new reprocessing facilities and therefore, it was required to invest in further waste treatment facilities, in order to continue delivery of that particular business plan. And down the years, those discharges have been reduced very significantly by more than a factor of a hundred.

And I saw in a recent presentation to this body that it's a fact that most of the discharges into the Irish Sea, the North Sea, and the surrounding waters are actually not from the nuclear industry but the point about discharges is this; that each industry has to take care of its own and the perception of discharges in the public's mind is very relevant to whether or not you'd be able to license a facility.

And I don't believe that that basis would be a suitable basis for GNEP in terms of discharges and I'm going to talk about that in a moment, but if we get the chance, we'll talk about the specific discharges.

We've put this picture in. It's a picture of the Sellafield site and really, it shows the generation of plants. I don't believe that people can see the picture. If they're looking at the picture carefully, they can see three generations of reprocess following the labels. The first generation has been shut down for many years. It was the original military processing plant. It was a Butex facility and it's undergoing decommissioning. The major initial deactivation is being completed and some equipment removal is also being completed.

The other two facilities, one known as Magnox is a metal reprocessing plant, 1500 ton a year capacity. It's over 40 years old and as I'll mention later, it's been substantially upgraded. And the third facility is the oxide fuel reprocessing facility and that's where we deal with the light water fuel, BWR, PWR fuel and advanced gas reactor fuel, which is a peculiarity of the British nuclear industry in terms of reprocessing.

The site contains all of the requisite

waste treatment facilities and as we go on, we'll see them more carefully but really this just illustrates that if we wish to contemplate, and we do wish to contemplate recycling in the Unites States, it's not just the reprocessing facility that we have to be thinking about. We have to be thinking about the waste treatment facilities and we really have to integrate the waste management into the process to avoid having or to avoid or reduce the size of the actual waste treatment facility, so by flowsheet design, et cetera, we can do that.

As a closeup of the third generation facility, the thermal oxide facility and I just want to show this because when people talk about reprocessing and I've read, for instance, the papers that have been issued about GNEP, and people talk about head-end processors, the so-called chop leach processors, et cetera, if we look at this picture, you can see the three red stairwells, which neatly divide it for the purpose of illustration, the reprocessing facility. The space between the two stairwells on the left, is almost entirely taken up by the head-end facilities.

And it's very easy to underestimate the amount of testing and development of processes that went into actually establishing those facilities. The actual separation facility is between the two stairwells on the right-hand side, and it's actually -- it's less than 50 percent of the facility. And I wanted to just illustrate that. The approach that EnergySolutions would take and just move on, Colin, please, I've mentioned a lot of this already so I won't dwell on it. So I'll just make the point that today's facilities are designed for a number of things, safety and operability and that includes commissioning and we passionately believe that design, operations -- design must take into account all phases, construction, operations, including commissioning and decommissioning and that has to be from the outset of the process. And there are lots of examples around the world where that is not the case and there are a number of examples in the United States where that hasn't been the case.

I've emphasized the waste management already so we'll just move straight on. In these facilities, they're based on five levels of radiation zoning and contamination zoning, five being the highest and they're inside the hot cells and one being completely outside the facilities. So one would be equivalent to any area in the world, as it were and it's important that the cascade and parallel ventilation is used to maximum effect in order to reduce the spread of contamination. And we do believe that going forward, that will be a key aspect of design in order to meet both ALARA considerations but also in order to be able to assure not only the regulators but anyone else that might be interested in the ability of these facilities to perform safely and meet all requirements with regard to discharges, both on the accidents and normal conditions.

The general approach to design, in the chemical plants we tend to go for what we call passive secure cells. All of the equipment is in there. It's robust equipment, but it's got no moving parts by and large, and so you get a lot of redundancy and diversity and mass is transferred through fluid energy devices. I've mentioned power fluids but also things like steam ejectors and air ejectors and other devices, air lifts, et cetera. And the whole philosophy is to design for life. It is possible to re-enter those cells and indeed, down the road, I will talk this afternoon, a little bit about where we've done re-entries but generally, they're built and built for the whole life of the facility.

And the mechanical handling cells on the other hand, are very robust. They're remotely maintained, they're highly active, and I'm talking sorry, about the highly active parts of these facilities. Obviously, as you come down the radiation gradient, then the facilities might involve concept maintenance or may not.

It's important that the facilities have got integrated inspections, surveillance and services which include secondary maintenance facilities and certainly some facilities have struggled throughout the world because there's been -- and you know, the United Kingdom is no exception, but have struggled because of the failure to provide historically adequate secondary maintenance facilities and that problem is being manifest in terms of both waste disposal and maintaining facilities and service.

I've already mentioned the auto-sampling and the integrated laboratory facilities. I'll just point out that the flow sheets today need to be designed to reduce liquid and solid waste and I'll talk about that very briefly. I mentioned the word salt free and certainly in the original Purex flowsheets people talked about people used iron, ferrous sulfonate in the reductive process where it's possible. One of the consequences of that is that you're limited on the concentration that you can take the residual liquid to, the high level waste generated, and one of the approaches that we've taken is to eliminate salts wherever possible from the process so that we can get maximum concentration of high level liquid waste. And that enables you to also route what historically is known as secondary waste into the high level waste stream and get the benefit of concentration and incorporation in glass which is the disposer for high level waste.

I'll just talk very briefly to the concept of passive secure cell. We're looking here, a typical cell, those shield walls are typically 6 feet, 2 meters thick and the vessels in the base of the cell, this is a pretty empty cell for illustrations purposes. I don't know if you remember the picture that I showed earlier of two gentlemen stood inside a highly active cell during commissioning. You could see the actual typical congestion that you get in these cells. They're generally full and they're built in such a way that you can get maximum benefit from the volume. That's got an important bearing on decommissioning which we'll talk about in a moment.

But the principle is the primary containment is the vessel, the second recontainment is the lining of the cell. In this case, this just shows a partial lining and the concrete walls, they may be treated or they may not be, depending on what the actual process activity is.

To the right of this cell it shows a medium active cell where we decide that we're going to change something out and in this case, it's filters and that typically shows the design arrangement for removing the -- you can see the filters in an array below the floor on the right-hand side of this picture, and if we wanted to change the filter, you would bring a flask in and change it out. And the design were with facilities for wash-out, et cetera, and then insuring that the operators are not exposed to either contamination or direct radiation.

The top of the floor there shows the service floor and it shows the provisions for putting steam in or air or any of the service, plank washed cabinets, et cetera. Essentially, that's very different to the design features that I've seen in the 10 years that I've been in the United States where the canyon principle is the general design that is being used here in the United States. And you pays your money and you takes your choice. We certainly examined a number of years ago when we were thinking about building the third generation facilities, we looked again at whether or not canyons presented a cost advantage and we couldn't find a cost advantage and so we determined that we would stay with that particular approach.

Approach to the next generation and what we would do for GNEP, the technology is based on an enhanced THORP facility. But I'd like to just talk first of all, about what advance technology might mean and some of you, I know you've heard me say this before, but you'll have to bear with me. In any facility, a facility is made up of equipment, processes and the systems that you use for controlling those processes. And I'm oversimplifying it, I know, but if any one of those three could be advanced and you would have advanced technology by aggregation. We believe that in order to achieve the goals for GNEP, it is possible to do that using substantially proven equipment to carry out the actual process.

You would deploy advanced processes on that equipment. But the flow sheet will be designed to meet all of the GNEP goals of waste management, reduction of waste, toxicity, taking care of the heat generating components, producing the trans-uranic group products, et cetera. We believe that the most cost-effective way is to take what I would call an I incremental approach to reaching the ultimate GNEP goal, the full vision of GNEP which is to be able to recycle spent fuel from fast reactors and from the recycling reactors.

In the case of LWR fuel, and our NUEX flowsheet, we're building on something that we did in fact, develop for the THORP facility but it is not deployed in the THORP facility and I mentioned technetium chemistry. I'll now mention neptunium chemistry. It is possible to separate neptunium and plutonium and uranium in a single cycle from the fission products and that is certainly an element of our approach. And it requires careful control of the chemistry states in the separation cycle but we've demonstrated that that is possible.

And we decided to run with that because we also felt that americium and curium presented particular challenges, not only from a separate point of view but down the road and it may be, we certainly -- we've designed the facility. We've got a conceptual design where we can produce a single trans-uranic product, plutonium, americium, curium and neptunium, a single product of uranium which meets all of the purity requirements but we could very easily separate the americium and the curium as a separate product and as someone speaks to in the paper, americium and curium for targets and all of the rest, there are benefits that flow directly from that.

The key about the facility is that it needs to have intrinsic and extrinsic proliferation resistant features and intrinsic, for instance, there would be no pure plutonium. Now, people talk about the spent fuel standard and clearly if you separated the fission products from the trans-uranic group then you have to find another way of having an equivalence to the spent fuel standard and we would do that through engineered features in the design of the facility.

An advantage of the passive secure cell of course, is that it's not accessible directly, and so if somebody managed to get past the extrinsic proliferation resistant features, you pass the guards and all the rest of it and get into the facility, they would not be able to just get into the passive secure cell. Now, we might get to that in questions and answers but it is possible to get into that, but it's not something you would do in a few hours. It would take some time.

Now, it's equally possible that if that

entry was made, then that's where the engineered features to provide the radiation field which provides the equivalence to the spent fuel standard, the 100 amp per hour is required -- comes into its own. The facility would require states of the art and it just goes without saying, states of the art control systems, including nuclear materials accountancy. And certainly EnergySolutions doesn't profess to have what I will call the state of the art. It's got the best of current use but I do believe that some of the work that's being done in the National Labs could be used very usefully to enhance that, some of the work done in Sandia and elsewhere, then that would be our intention to get the state of the art.

There are certain features in the flowsheet which enable us to do safeguarding and tracing very nicely and that's important. I've already mentioned integrated waste management. We believe that you wouldn't be able to get approval for these facilities if you were not able to demonstrate that you had waste forms and suitable pass for disposal.

And some of that might present a challenge. Zero or near zero liquid discharges, we believe is also a goal and that's clearly an essential difference to what I was talking about earlier in the European reprocessing facilities. It is true that the current generation of facilities are very, very low discharges compared to the second and first generation facilities but, you know, I'm not sure that they would meet the requirement which I think will be near zero.

And lastly, EnergySolutions believe that the GNEP facilities do have to be on a commercial site and should be and can only go ahead if a commercial approach can be established. In other words, we have to be able to demonstrate that there is a commercial reason for doing this work. I actually believe the environmental impact will drive the design. Safety will drive the design. All sorts of rulings will drive the design but I believe that the key thing that will really drive design is environmental impact and the waste management issues.

I'm going to take a breather and now back to Colin.

MR. BOARDMAN: Thanks, Alan. I won't take too long on this slide but really it's just an indication that although as Alan has spoken to, we have a particular technical approach to WR fuel, we're not stocking that. We have actually acquired and are continuing to develop a range of what we would call for definition sake, gen 4 technologies, if you will for recycle and so there are some particular areas that we've taken to the state of having indicative costing for these technologies in terms of molten salts, pyroprocessing for which we have some specific patents, advanced solvents which are further enhancements of the sort of flowsheets Alan has spoken to.

And on the equipment side, for instance, some improvements in some of the contactors and current day equipment in terms of centrifuge recontactors and I think Alan will talk to those in a moment. All the technology that we have looked at and investigated but not taken to costing stage, fluoride volatility, fractional crystallization, precipitation and carbonyl volatility, and a couple of other emerging technologies we are involved in, a super-critical fluid extraction, generally based on super-critical CO2, and ionic liquids.

It would be useful to talk a bit more about centrifugal contacts in the context of passive cells and so on.

MR. DOBSON: Okay, we did, in fact, look very carefully at that. It's very clear that in most of the work done by Argonne, and ODNL (phonetic) and others, the centrifugal contactors were being adopted as the principal equipment for the flooring separations. And I've already said that we would look at using commercially proven equipment where possible. In the nuclear industry, centrifugal contactors are not commercially proven at this stage. We've certainly got one application that's getting fairly close to commercial proving and it's a fairly large scale application. However, our approach and thanks Colin, we've got a nice exploded view of the THORP facility and if you look towards the left, yes, the left of that picture, and you can see the pulse columns in the highly active cell.

The yellow in that picture is the uranium purification cycle. And first of all, let's suppose we decided to replace all of those mixer settlers on the right. So they're those kind of flat yellow boxes towards the right of the picture. If we decided to replace all of those with centrifugal contactors, you absolutely would get a reduction in volume of the facility for the contactors but you might be able to see down at the bottom some of the larger tanks in the facility. And what we're finding is that you can't eliminate all of that tankage.

In order to be able to retain process control of the flow sheet with centrifugal contactors, you still need that tankage or a substantial part of it. And so there is -- without any shadow of a doubt, there is a benefit gained by using centrifugal contactors from a space but it is not as substantial as perhaps people might think. And in fact, we looked at this very carefully and we felt that the only appropriate place to use centrifugal contactors was almost in the polishing stage for the americium curium extraction for the LWR recycling. That's -- you know, it's EnergySolutions' view and we believe that if we were to do it that way, we would confine our development work to the integrated hot process demonstration on a very small scale. You would not need to do that on a very large scale.

And it's important to understand the difference between large scale inactive test requirements which is required to prove the chemical engineering and the process dynamics as opposed to proving the process chemistry with hot radioactive materials. And we believe that that's an important factor when it comes to actually working out what these facilities are really going to cost. And yes, we absolutely could replace every one of those contactors with centrifugals and the cost would go up because we would lose the advantage of the commercially proven equipment. And there are two things that you need. There's much more than two, sorry, but two that are very relevant to this discussion. The residence time is a key factor of the material in the contactor and so if you've got a very high radiation field, and a sensitive solvent, for instance, that might be an important consideration.

There are criticality concerns all of which help centrifugals. What you actually might want a slow -- or you might have a chemical reaction that you wish to go to completion that is a slow chemical reaction and a centrifugal contactor is absolutely not the right thing to use for that application.

MR. BOARDMAN: Okay, I'm going to try and accelerate a little bit but essentially, we took these topics as we move through the discussion, so an integrated approach to waste management in total is really one of the key aspects that we think needs to be implemented and this one is right away through from flowsheet development where the flowsheet does not stop a purely separations of fuel elements. You have to norms into what you do with the off-gas, what you do with some of the solids and other residues and certainly the liquids. So this is just a mantra that, you know, we have adopted over the years and we absolutely think it's a fundamental. Part of the answer is in terms of the designed facilities and some in the way you operate them and actually behavior aspects. And so waste avoidance and encouraging behaviors that push you toward that waste minimization, all of it really designed and focused on integrating the waste approach and avoiding the formation of orphan waste, that is waste that actually don't have a disposition.

A key waste that we think will have to be tackled are certainly hulls and ends, which are basically the skeleton of the fuel, if you will, zirconium cladding and MPCs. In the UK these are basically put into a cement form an calculated in the cement form. Right now, and in the UK, of course, they are -- that's defined as an intermediate or medium active waste and there is not related category in the USA. So in the US we hope we can find ways of making sure that hulls and ends are not defined as a high level waste. We believe recycle offers value in terms of improvements to the repository usage, much more benefits in terms of how much material you can get in there. If hulls and ends don't go into that repository, then that's going to negate a lot of the benefits and so we're doing everything we can to come up with processes and approaches that can avoid that.

So certainly, based on the UK experience, these would be above Class C low level waste if not treated. So things we're sort of looking at are enhance the solution techniques in turning these other material into the process. This would remove residual fuel and then we'd look at disposal as a Class C waste. So processes like electro-chemical dissolution, chemically enhanced dissolution with prolonged exposure, a process that we're looking at, and considering.

We're also thinking about whether we can drive in some way some of the outpourings from this into haulable waste form and also considering new encapsulation processes and maybe melting approaches. Just a quick idea of what the facilities look like, this is a waste encapsulation plant, WEP at Sellafield which is the facility that deals with the hulls and ends. There's an external view at the top left. The view in the center is a 500 liter medium active waste container which is the container into which the hulls and ends and other wastes are tipped inside a remote cell and either paddle stirred or vibro-grouted and then there's a capping grout put on top.

The bottom right picture is a photograph of the product store, so basically, you'll see spillages which contain a number of the waste containers and the top right is actually inside of a filter cave. Alan referred to the diagram of the passive secure cell area. One of the things that we found was giving lots of problems on the original early plants itself was the fact that in the HVAC systems a lot of the filtration is distributed around the system. And when you were doing filter change-outs and so on this was a real operational issue.

And so currently day designs make sure all the filters are already built into a passive secure cell with all other remote handling equipment designed in so what happens is the actual maintenance, routine maintenance and change-out of filters becomes a fairly routine operation and of course, it's already inside the waste plant and is connected to its disposition routes. That's a pretty significant detail but again, it goes out to the benefits from a capital cost and operations standpoint.

Haulable liquids, basically we have two sets of experience base. One of them is our own EnergySolutions. We did acquire GTS Duratek just over a year ago. Along with that came basically what is the US BDAT for vitrification which is geo-heated melter. We also have an absolute wealth of experience based on the operation experience of people like Alan and his team from the Sellafield vitrification plants which is actually based on French technology but we probably would not go down that route for these new applications.

Effectively, we're proposing to take and receive out and try and avoid the long-lived isotopes that cause long-term heat generation in the repository. We're vitrifying residual fission products including cesium and strontium so we differ from the OX process. We see no benefit in spending time and effort in extracting cesium and strontium which are going to give you yet another waste stream to manage. Our approach is to simply let that go where it goes today, in today's plants, into the glass and delay store for 70 years upwards until the heat source is gone and you can then place that material in the repository without that near-term heat generator.

Effectively, the JCM that we probably favor for today's vitrification approach is the US BDAT today. It's very adaptable to large volumes of waste and we have 30 years of advancement since the early days of vitrification the first time we implemented a vitrification process at Sellafield.

Just a look at the vitrification plant, again, top left, clearly is the external view, a very modern facility. There are three lines at Sellafield these days and the third line is much improved over the first two in terms of some of the issues and lessons learned we got from the commissioning phase of the first two lines, mainly to do with melter lifetime and a lot of issues with mechanical handling. The third line is just tremendously operationally more efficiently as those. A view of some of the canisters on the top right, canister welding bottom left and a view of the top of the vitrified product store with a -- some of the gamma gates which are used to load the canisters. There are 200-liter stainless steel canisters and they're stacked, I think, about 10 high in that store.

MR. DOBSON: Ten high.

MR. BOARDMAN: The store probably about this room is probably about a third of the store's floor space and in that area, so you can imagine circular slots, if you will, in the concrete matrix loaded 10 deep in a floor space about the size of this room, probably not much bigger is the fruits of 40 years of reprocessing fuel. So something like 50,000 tons of fuel and the high level waste that was generated from that is all sat in the stall in the floor space, although 10 deep takes up the size of roughly this room. So that gives you some idea of size. Alan, do you want to talk about affluence and discharges?

MR. DOBSON: I want to mention it and the zero liquid discharges is a challenge but we do believe that flowsheet modifications will help us -- further flow sheet modifications will help us in this way. Obviously, concentration of the liquid waste and getting as much as we can down the high level waste route is another important aspect and being able to get all of the liquid waste into the high level waste is a key, but there's a volume issue there and I don't want to understate that issue.

And if we're unable to get the liquid waste down that route, then we will be looking at getting it into solid waste for shallow land burial. And we're planning to use extensive water for recycle. When I tell you that the largest liquid volume is from the fuel cooling pump, which is very low activity, but nevertheless high volume so that gives a clue as to how we would modify the front end of the facility to help meet this requirement. We're also looking at recycles and reagents used and management of the solvent and I would make a point that in moving from the second generation to the third generation facilities, we changed the approach to solvent management and we'd accumulated over the years quite a bit of solvent from those first and second generation facilities and we had to build a solvent treatment plant to process that solvent into a form suitable for disposal. To this day, we have not actually generated and waste solvent from the thermal oxide and that's a testament to the efficiency of the solvent management. And we had to add solvent because there is some loss of solvent from the process, a small amount. There is some degradation of solvent and there is a small amount entrained in some of the liquid that is not removed by separation. It has to be separated separately and then recycled back into the facility.

But we have no waste solvent from that facility which we believe is a very important feature going forward. On the aerial side, in the facilities that we were talking about earlier we do, in fact, remove carbon as a carbonate, so Carbon-14 is driven off in the dissolver and we do, in fact, trap it and dispose of it as a solid waste and the iodine is also driven off with the dissolver and is trapped and caustic scrubbing. And we use conventional -- what I call conventional off-gas, so it's a mixture of scrubbers, electrostatic precipitators and filters and the real secret is to get those in the right sequence.

I used to be in the chemical industry before I joined the nuclear industry and we always operated scrubbers before electrostatic precipitators and we found that you could get incredible DF's if you chose the right combination of wet scrubber and put it after the electrostatic precipitator and I don't fully understand the physics, but it's something to do with the ionic charge on the droplets that are coming off enables them to coalesce. And the sparingly volatile technetium we have to deal with and we deal with by dragging that into the high level waste stream by flow sheet management. And there are alternatives for trapping krypton. Could you just move on, I have done that already.

There are alternatives for trapping krypton and we took the view that on a risk management basis, that the risk presented by the stored krypton is actually greater than the risk presented by the discharged krypton. So the treatment facilities in the United Kingdom do not have those krypton removal or krypton abatement facilities. And I think I've covered most of the points on that.

D&D and cleanup, here in the United States we've completed the decommissioning of ETTP, which was the Donner Oak Ridge. It was -- it is still the biggest cleanup project probably in the world and to put it into context, I think the whole of Rocky Flats buildings would have fitted inside two of those buildings that were decommissioned down at Oak Ridge. Our experience includes power reactors, plutonium facilities, separation facilities, and uranium facilities, some of which are in the US and some of which are in the UK. We've done a lot of work on fuel pool cleanup and also fuel pool decommissioning.

And last but by no means least, tank closure is a major issue here in the United States and it's one of the things that preoccupies most federal contractors on the DOE side and we've actually experienced the emptying of tanks and closing of tanks. Key lessons learned, I'm not focusing on any particular thing but safety, quality and production, if I say that you've got three legs of a stool there and take any one of them away and the stool falls over. And that's a key lesson and quite often people get focused on one or the other to the detriment of the three and we really do believe you've got to have an equal focus. Safety is paramount but you have to have an equal focus.

Most events are actually avoidable and predictable and it leads us into the belief that that's the way that you prevent accidents, by focusing in on prediction using leading indicators, using proactive measurements so that you avoid accidents. I make the point that lessons are very easily learned and you -- you know, people are familiar with the nuclear industry. Anywhere in the world, will be familiar with the vast volume of lessons learned and they're probably familiar with the fact that many lessons appear to be quickly forgotten and events. There's an amazing high rate of event repetition, despite the fact that lessons were learned and we do think that that is a key area for attention for any people operating any nuclear facilities going forward and GNEP will be no exception.

I've already mentioned that it's very important to have the entire team that's associated with a facility in there at the beginning; operators, technical people, the engineers who will design it, the people who construct it and the people that are going to be responsible or have something to do with decommissioning, because it's really important that those people address issues early in the phase of the design.

D&D features and requirements more increasingly today are getting into new design but I can absolutely say that 30 years ago, they didn't feature at all on the agenda. And it's only in the last 25 years that really designs have begun to incorporate decommissioning. So in my personal experience, I'm sorry, it's only in the last 25 years. Software controls, they readily are overused and they're absolutely no substitute for good engineering. Prudent investment can save a hell of a lot of cost throughout the life cycle and including particularly the D&D costs, the operating costs also.

And one size does not fit all and both in the licensing process and in the operation of facilities and I would say that true conservatism is a virtue. I would say that unbridled conservatism is an absolute vice. It is possible to reduce the cost of facilities through innovation and design and construction. I've tried to speak to some of that. And it's also true that life cycle costs are absolutely driven by design and you have to take together the front -- the requirement to invest in the front end to get the design right, if you're really considering life cycle costs and in a commercial venture, that is absolutely paramount.

And it is possible through diligent use of HAZOPS and I don't know if people are familiar with Hazard and Operability approaches. And quite often there's an emphasis on hazard in Hazard and Operability Assessments. Quite often operability is overlooked and in actual fact in the D&D world particularly, the HAZOPS, if you use HAZOPS diligently and really make sure you cover both the operability aspects of conducting the D&D work, significant hazards can be avoided and accidents avoided. And it's vital to identify waste disposal pathways and historical data is often unreliable, incomplete and inadequate. The state of the plant may not be what you think it is. It's not just about the state of the material on the facility and experience has shown in a number of applications that the engineering records are absolutely not correct for facilities particularly facilities over 30 or 40 years old. And with that, I'll hand it back to Colin.

MR. BOARDMAN: Okay, well, again with eye on the time, we have overrun but it was always going to be difficult to take a topic on like this in 45 minutes, so I appreciate your indulgence. I'm not going to read this but again, thank you for the opportunity and we'd be pleased to field any questions.

VICE CHAIR CROFF: Thank you very much for a very interesting presentation. I'm sure there will be a question or two. We've got, I think, about a half hour for questions and I want to make sure to give our two consultants a crack at it, too. So I'm first going to start with Jim and work our way around.

DR. CLARKE: Just one question if I could, you are proposing to separate americium and curium. I'm just kind of recapping my understanding of what you said. You're going to leave cesium and strontium in the glass. You're going to leave technetium in the glass as well, and you're going to separate americium and curium. What would be the final disposition of that separation product?

MR. DOBSON: The disposition for all of the americium and curium would be separated. They're part of the trans-uranic group. And whether they were kept as a separate stream or mixed with the plutonium and neptunium is determined by how we decide to go down the trans-uranic route is determined by reactor considerations and all the rest, fuel fabrication but the absolute disposition would be to burn that material in a reactor of some kind.

MR. BOARDMAN: Either through incorporate it in a fuel design or by manufacturing separate targets.

MR. DOBSON: And, you know, people familiar with reactor physics will recognize the benefit of the statements about targets and the impact on the whole cycle in terms of amount of reactors required, et cetera.

DR. CLARKE: So that could be used as fuel for advanced burner reactors.

MR. DOBSON: I mean, the GNEP goal and the requirements is to product a trans-uranic group that can be used for fuel for advanced recycling reactors and that's the compliant response to that requirement today in GNEP. And we've just suggested that, you know, a number of issues can be addressed if you take a slightly different approach.

DR. CLARKE: Okay.

MR. DOBSON: The cesium, strontium and technetium would be in the high level waste and vitrified and we do believe that engineered delay store, as Colin eluded to, it's a relatively modest building. Engineered delay store for a few tens of years actually is as good a solution as putting that cesium and strontium into Yucca Mountain straight away. I mean, the design of Yucca Mountain provides for forced draft cooling in the first, I think it's 80 or 100 years and it's entire due to the cesium and strontium.

DR. CLARKE: I understand.

MR. DOBSON: So let's say the power -- let's not do a separation for separation's sake. We can do that separation by the way, but let's not do it for separation's sake.

DR. CLARKE: I understand, I understand.

MR. BOARDMAN: There's quite a few cesium capsules around the complex right now that have been there for awhile, so we won't know whether it's a really good thing to make any more.

DR. CLARKE: I understand. I was curious as to whether the americium and curium as a separation product would be a separate -- or have a separate disposal path while you're just --

MR. BOARDMAN: The answer is, it could be.

DR. CLARKE: And if I could just make a comment, Alan, the -- I think your emphasis on environmental impact and integrated waste management at taking lessons learned up front and factoring it into the decommissioning lessons learned, in the design, these are things that are very important to this committee and we really appreciate that. Thank you.

VICE CHAIR CROFF: Ruth?

DR. WEINER: How do you define high consequence? You talked initially about high consequence processes, high consequence. What is the -- I'm just confused. What is a high consequence?

MR. DOBSON: Well, my -- in the safety analysis point of view, a high consequence event is one which has great impact on the public and the environment or the worker and --

DR. WEINER: Or the worker.

MR. DOBSON: Or the worker and there are accepted tables that define, you know, what the event would be in terms of the amount of material released or the resulting exposure and there are agreed and accepted ways of engineering to prevent that. Or sorry, not ways of engineering but the criteria that you have to meet, your engineering has to meet.

DR. WEINER: I was just curious. So you define it essentially in terms of high dose.

MR. DOBSON: Effect.

DR. WEINER: Or high exposure.

MR. BOARDMAN: Of an outcome.

MR. DOBSON: Outcome.

DR. WEINER: If you will.

MR. BOARDMAN: The definition of a high consequence is outcome --

DR. WEINER: Oh, thank you, I was --

MR. BOARDMAN: -- as opposed to the likelihood of that again happening.

DR. WEINER: Yes, I understood that. I was just curious about that. What sort of volumes do you expect from your waste solidification? In other words, we hear arguments frequently that if you -- that the net volume of waste -- if you recycle fuel, the net volume of waste decreases and I'm just talking about volume now, not about specific activity or about activity. How do you react to that statement? What is your anticipation of the volume of waste that you would get from a -- what waste -- what volumes do you get from your recycle facilities as compared to the volume of the spent fuel and of the feed that goes into it?

MR. DOBSON: The actual volume of the high level waste compared to the volume of spent fuel in the waste, it depends whether you take the volume of that waste purely as itself or the volume of that waste in its containers for disposal but there's a volume reduction of about -- depending on which of those you take, anything from about five to one and some people would claim better than that, some people would say well, it's actually 10, but I think it's safe to say it's about five times lower in volume and you know, in terms of the amount of material incorporated in the glass that, again, depends on the fuel characteristics and it can range from the low single figures of tons to the high single figures of tons per container.

And that's why -- I ought to say, that's per container as we showed in that picture which is the -- it's actually a 400-liter container. It's about 500 nominal, and that might contain a few tons of fuel equivalent.

DR. WEINER: But from the purely volume consideration, you're looking at or what I just understood you to say was you have an approximately 80 percent decrease -- you get approximately 20 percent of the volume --

MR. DOBSON: High level waste.

DR. WEINER: -- of the volume that you have to dispose of, of waste, as compared to the spent fuel that you --

MR. DOBSON: On the high level waste stream. Now, Colin mentioned the hulls and ends, and that volume would increase and I don't know the answer to what the final volume of that would be if it did -- it's not actually classified as high level waste today. It is not high level waste by definition. But it couldn't be disposed of as Class C, because it's greater than Class C. And I don't know what the volume would be because we haven't -- we're going down a high level disposal route, so if we were unable to reduce the residual activity to meet say Class C and there was no change in regulation, for instance, which some people have talked about, then I don't actually know that volume, I'm afraid at this point in time.

We haven't actually -- we have estimates of that volume but I think it would be of a similar order if it went down the high level waste and it would reduce the advantage, probably, by 40 percent. But that's purely an educated guess.

DR. WEINER: Well, this is really -- I was just interested in broad scale numbers. I have one final question and that, and this is a matter that has confused me. When you talk about burning up the actinides, the residual actinides, don't you get waste from that process also? How does -- what is the balance of waste versus -- of basically stray burned-out -- stray radioactive waste that you get from a burn-up process? Doesn't the produce some waste as well?

MR. DOBSON: Well, the thinking is that you will convert those actinides into fission products that are not consequential for repository disposition. So in other words, they would not be -- actinize themselves, so there wouldn't be the long-lived heat or radiotoxicity associated with the actinides.

DR. WEINER: So you're looking at burning all of the actinides to smaller radionuclides.

MR. DOBSON: Indeed, and of course, the requirement -- the challenge to that is can you do it in a single cycle or can you -- or do you have to do -- repeat runs of that. And at this point in time, depending on the species, there's a belief that you can do it, for instance, with americium and curium possibly in a single pass. And I'm not saying for certain, I'm just saying possibly.

With plutonium, we'd have to change the reactor configuration compared to how we operate reactors today and I'm not sure that it could be during a single pass. And so that then opens up the question as to well, what do you do with that spent fuel, and clearly, you would need to reprocess it and then you get into the recycling of trans-uranic fuel.

DR. WEINER: Thank you.

MR. BOARDMAN: That's probably the biggest unknown if you look at the GNEP program right now. It's probably the biggest unknown in our view at least, is what to do -- what sort of fuel, new fuel, what type of new reactors and what the implications of that are and so I think, clearly there's a lot more work and a lot more thinking to be done on those topics right now.

DR. WEINER: Thank you.

VICE CHAIR CROFF: Mike?

CHAIR RYAN: Thanks, Allen. I'm going to nominate one to be a bigger unknown. In the current road system there's three tiers of waste for everybody that reprocessess, the US has two tiers which you took note of. There is a provision in 10 CFR where the Commission can approve alternate schemes of waste management, 61.54. Have you examined your process as to how it fits in our two-tiered system and will you generate waste that can't be disposed of at this point?

MR. DOBSON: There is a possibility that

we may generate waste that could not be disposed of in the two-tiered system.

CHAIR RYAN: What would that be?

MR. DOBSON: Well, I've already mentioned the hulls and ends. We actually think that from a radioactivity point of view some of the gaseous effluents are going to be okay for shallow land burial or they're very close at this point in time, but I cannot make that as a definite statement because my experience relates to up to 50,000 megawatt-day fuel and we're looking at up to 60,000 megawatt-day fuel in this instance.

CHAIR RYAN: Of course, we're not thinking about diluting stuff to meet a concentration limit.

MR. DOBSON: No, no, I'm talking about taking the material as it's being removed in the existing removal processes and I do believe the single biggest challenge is the are there hulls and ends and that's why we're looking very hard at trying to remove from the hulls and ends the residual activity.

Today that material is greater than Class C waste. There's no shadow of a doubt.

CHAIR RYAN: Of course, even that would be a problem, too, because you've got to process the concentrates now, so that would be a waste stream that probably has not home in a two-tiered system.

MR. DOBSON: Well, of course, if you get it out of the -- if you remove the material from the hulls and ends, it goes right back into process.

CHAIR RYAN: Where does it end up ultimately?

MR. DOBSON: It ends up as product, so it's either uranium and plutonium that's going to product --

CHAIR RYAN: What about technetium?

MR. DOBSON: Oh, sorry, I didn't realize you said technetium, sorry. Well, I think technetium can be disposed of as high level waste.

MR. BOARDMAN: As part of the glass --

MR. DOBSON: As part of the glass formulation.

CHAIR RYAN: Now, I'll -- yeah, well, maybe in the glass, okay, I see that. Again, there are lots of reaches out here. We're in a two-tiered system in the US. I'm a friendly skeptic about where all the wastes end up. I think it's a complicated thing. That's one point.

The other question, I'm not going to have a lot of time to go into detail on the waste stuff, but THORP has been in the news a couple of times in the last few years and that's a facility that's operated for 50 years or so on and off with different hats and different evolutions and so forth, right? Not THORP itself, that's a relatively new plant, fair enough. And you know, there have been some significant issues and fines and whatnot.

How is a new plant -- how would you take that experience into a new plant to say this is going to operate for four or five decades and not have similar problems?

MR. DOBSON: Well, I think that the specific issues that you refer to in THORP are understood and the issues are of great concern, great management concern and therefore, great concern to the regulator. And my understanding of the cause of those issues -- and so that everybody is aware, the last issue that I'm sure you're talking about was where material was lost from primary containment and retrieved from secondary containment.

CHAIR RYAN: Loss of liquid.

MR. DOBSON: A loss of liquid and as a matter of fact, that was a predicted event and the real issues -- and indeed, there were two vessels in that stream and the vessels were accountancy tanks which are raised and lowered. And it was known that by raising and lowering those accountancy tanks so that you could weigh the vessel, you would put stresses on the pipes and engineering predicted the number of cycles that you would get a failure.

And indeed, a failure occurred and the pipes sheared and the material escaped. And that, in itself, is an issue but the design features provided for the recovery. The real issue was the management of operations and a control of operations issues because information was available and was not acted upon and I can't really speak for the management of the --

CHAIR RYAN: No, no, I appreciate that, and that's part of your three-legged stool.

MR. DOBSON: That's part of the three-legged stool, absolutely.

CHAIR RYAN: I understand that point, and again, I appreciate your view of that three-legged approach, but now that that's happened and you have some of that experience behind you, how do you take care of that in designing the new plant or GNEP type facility that will operate for similar periods of time so that those things don't happen? I mean, is it an engineering issue, management or all three of those?

MR. BOARDMAN: I think all three.

MR. DOBSON: It's all three. It's engineering, management and --

MR. BOARDMAN: What we did learn was that some of the engineering features that were built in worked, so we keep them, but there are other aspects of what was learned that would have to be addressed and changed and would be.

CHAIR RYAN: And I guess I see that as a challenge of GNEP as a whole. We've seen other presentations where we see 40-year Gant charts for design, construction and operation, you know, that have the milestones down to a month. So it's pretty challenging to think about some of those things in that kind of time frame over many decades where -- and I appreciate the problem you have in designing a process, where many of your key assumptions have a big question mark on them right now.

MR. DOBSON: I would actually say that the second reprocessing facility has actually been operating for over 40 years now. Engineering assumptions were made then which have held good but back-fits have been made to those facilities. So for instance, the dissolvers in those facilities reached the end of their operating life and it was possible through the provisions made at the time, we were able to decommission those facilities and remove and replace, very highly active work, but those provisions where made.

So it is possible with sufficient forethought and with sufficient knowledge and experience to put together a comprehensive set of provisions. And I draw an analogy in a way with TMI. You know, IMPO was formed immediately after TMI and lessons were learned and they've been applied and it is significant for this project, if GNEP gets underway and it is realized, I think a similar approach has to be taken. You have to take care of the engineering. You have to take care of the operations, and you've got to make sure that you've got appropriate standards by which to test and judge that people are qualified and trained and all the rest of it, and the arrangements are being implemented.

CHAIR RYAN: I couldn't agree with you more. I do think, though, that the waste management part is probably going to be the tail that wags the dog.

MR. BOARDMAN: I do have one comment to make.

CHAIR RYAN: Yeah, sure.

MR. BOARDMAN: There's a major

consideration about -- if you're fitting waste stream into a two-tier system or into any system in fact, is you know, can we get to the point where we have disposal for waste? Well, probably, but what does it cost? And so how the cost of waste management fits into the life cycle cost of recycle of fuel is a question. And it's one we're acutely aware of and it is one that's in our thinking when we look at you know, different new processes for dealing with things like the hulls and ends. There is a route to disposition those in the UK and not out in France, we know that. But whether that fits this is a question. And if it doesn't what do we do, what does it cost, what's the impact of that.

So you know, it's quite a complex question.

CHAIR RYAN: Thank you both.

VICE CHAIR CROFF: Bill?

DR. HINZE: A slightly different approach, while we have access to your expertise; briefly, what's the state of the art with regard to vitrification and what's on the horizon and what kind of durability, longevity do we see for the logs.

MR. DOBSON: That's a big question. I mean, state of the art, if you're looking the US and

Japan it's geoceramic melters. They've been operated very successfully. If you look in the UK and France, it's a two-stage process involving calcination and then melting and induction heated furnaces, et cetera. And the cold crucible is being developed and I don't believe that there's been a commercial application of that at this juncture. So I think that there are processes. I'm very familiar with the operation of existing vitrification facilities. I'm not as familiar with the development of next generation facilities.

Certainly, we would propose to use the technology that we're very comfortable with, which is dual ceramic melting for the high level waste from LWR recycling.

DR. HINZE: And what about the longevity of the fake rocks?

MR. DOBSON: The glass locks.

DR. HINZE: Right, I call them fake rocks, right.

MR. DOBSON: I don't actually have the numbers to hand, but I certainly am aware that -- and we certainly did test to certain durability criteria, leach testing and all the rest of it, and that has been accepted by authorities both here in the United

States and elsewhere. But I have to confess I can't give you the numbers of that. I could certainly supply that information.

DR. HINZE: If there is any information that would focus in on that, I'd very much appreciate it. Thank you.

VICE CHAIR CROFF: Thank you. You noted that your off-gas system removes iodine and carbon-14. What kind of decontamination factors do you get in a real system in a big plant?

MR. DOBSON: It's certainly greater than 90 percent and it's fairly close for carbon, it's fairly close to 99 percent.

VICE CHAIR CROFF: Okay, and iodine is around 90?

MR. DOBSON: It's greater than 90 and I actually think it's over 95 percent, but I actually tried to get the precise number earlier today, and unfortunately, I didn't get that number.

VICE CHAIR CROFF: Okay. Thanks. Second, could you say a little bit about mixed oxide fuel fabrication? First, a little bit about, you know, what's going on in terms of just plutonium, uranium mixed oxide and then what issues you might see arising if you were to put in neptunium or americium or curium into the mix?

MR. DOBSON: Well, I think mixed oxide fuel has been produced for many years. It's been produced for both light water reactors and fast reactors and it's been produced successfully. Again, I'm not a fuel expert but a key question in my opinion for mixed oxide fuel production is what impact would the high radiation levels associated with americium and curium if it was in that same fuel mix have on say the binders that were used for that fuel fabrication. I think that that question is still to be answered and other than that, you know and --

MR. BOARDMAN: In fairness, we don't make fuel and so it would be wrong for us to take a position that would imply we do. We don't.

VICE CHAIR CROFF: Okay.

MR. BOARDMAN: And so we have opinions, we have views but that's not based on our experience of fuel manufacturing.

VICE CHAIR CROFF: Okay, thanks. Ray, you got any questions?

MR. WYMER: I have several.

VICE CHAIR CROFF: Well, you've got your two minutes.

MR. WYMER: Right. The NRC Commissioners

have recently discussed the importance to the staff in any licensing operation of paying attention to the cost and efficacy of decommissioning. So I wonder to what extent, if any, decommissioning was taken into account in the construction of the THORP plant, and if so, what kind of things were important.

MR. DOBSON: It was. And materials of construction, they're an obvious thing, and where you use them and so for instance, stainless steel and where you use stainless steel. And so most of the -- well, all of the primary containment and a lot of the secondary containment is stainless steel. And in some cells the cells are completely stainless steel lined and that's specifically with a view to facilitating decommissioning, facilitating cleanup down the road.

And it is also possible to treat concrete surfaces with material and there is a great focus generally on the in-cell but in actual facts, experience from the historical facilities and THORP benefitted from this, is some of the most severe cleanup problems arose not from the highly active side of the process but from what you might call the interface medium active areas.

And it's really important to make sure that those areas are decontaminable and appropriate.

So epoxy resins have been used certainly and special paints have been used. And they cost less than stainless steel but not much less. Some of the epoxy resins are very expensive.

It's also important to design the facility for dismantling. So when you put a crowded cell together, which indeed you have to do to reduce the capital costs, you've got to be able to think about and how would you start putting that up? With remote tools, if you were using remote tools. And those kind of factors featured into the piping, layouts, et cetera.

Flowsheet is another area and materials that you produce is equally important. So materials, the type of equipment that you use was also a factor. So for instance, we might have chosen a particular vessel shape to facilitate washout over some other feature. You would put installed wash facilities in but again, a key lesson learned, it's a detail point. You know, when I joined the industry over 30 years ago, most of the cells even then had got wash facilities in them and they're absolutely helpless, you know, because you really do need either pressure or reagent to do washing.

Another feature that you have to take into account of is which reagents are you most -- do you think you're going to be wanting to use to do that decommissioning and how will you deal with them when they become arising from the clean-out of the facility. So all of those things were factored. So for instance, you clearly don't want an alkaline reagent or an acidic reagent get into an alkaline stream when it might release something, you know, which, you know, as you change the acidity, it changes the state of ruthenium.

MR. WYMER: That's probably enough on that question. My two minutes is waning away.

MR. BOARDMAN: The only thing with that is the degree to which we can modularize the construction and therefore, ease of disassembling, dismantle.

MR. WYMER: Good point. Okay, a second question I have is, you talked about a salt-free process. You're talking about electrolytic reduction or hydrolamine or hydrozine or things like that or is that --

MR. DOBSON: Salt-free, I'm talking about using U4, U6. I'm talking about using hydrozine.

MR. WYMER: Yeah, okay, that's what I thought you probably were. And finally, you talked about the importance of solids removal. I notice you had ultra-filters in advance of the centrifuges in the plant. Is that -- is your concern that the particulates might get between the rotor and the stator or is it concern about plugging the exist orifices or what is your --

MR. DOBSON: No, in actual fact, I've misled you. The ultra-filters were in a completely different facility. I was just using that picture to illustrate the design of a passive secure cell. We use ultra-filters for removing actinides in effluent treatment facilities. The ultra-filters are not in line between -- on the head end processes. We have some primary screening equipment but downstream that then goes straight into the centrifuges where the solids are removed by centrifugation before sending the clarified liquid into the separation facility.

MR. WYMER: To narrow it down just a little bit, is you concern specifically that the particulates might get between the rotor and the stator of the centrifuge and cause --

MR. DOBSON: That absolutely is a concern but equally, you know, you don't want particulate getting into pulse columns either, you know. I mean, the nature, the design of the packing in the pulse columns is sensitive to particulate accumulation and one of the key issues that we were looking for is making sure that solid particulates of the nature that comes from the dissolution process, was removed before we started the separation.

MR. WYMER: Of course, one of the features of pulse columns that's usually cited is their tolerance for solids as compared with --

MR. DOBSON: Well, it's much greater, but you know, you still don't want to get solids downstream.

MR. WYMER: Right, I'll put that -- let Larry ask his.

VICE CHAIR CROFF: Larry.

MR. TAVLARIDES: We must be thinking along the same lines, but I'm curious if you could explain a little more, if you can, the integration, at least that's the way I understood it, of centrifugal contactors and pulse columns? I can understand the need for pulse columns for slower extracting components, whereas centrifugal contactors will be advantageous for very rapid extracting units. And so how do you integrate them and how do you deal with surge capacity issues between different systems?

MR. DOBSON: Well, I mentioned, when I looked at that exploded view, control of the centrifugal contactors however many you use and for however many cycles, you've really got to look at the integrated control. I'm almost certain that you would need some inter-stage bufferage so you'd need tanks inter-stage and I made the point that on the process that we use for uranium purification where we opted to use mixer-settlers, because it's a pretty slow reaction and mixer-settlers are cheap. They're very easy to design, very easy to control, they're nice and almost quiet, as it were. But you still need inter-stage buffer tankers because you're doing different chemistry things. And I still think that that requirement is there with centrifugal contactors. And it will facilitate, therefore, control.

MR. TAVLARIDES: Sure, okay.

MR. DOBSON: What I am concerned about is if you don't have that, what is the effect of a dynamic passing right through the system?

MR. TAVLARIDES: Sure. If I can --

VICE CHAIR CROFF: One more.

MR. TAVLARIDES: Just one more. All right, what do you think you gain in the sense of storage demands when you vitrify cesium and strontium along with the hot other fission products in the sense, do we reduce the volume of storage after the seven-year cooling or is the volume still the same, you kind of -- a different type of storage?

MR. DOBSON: Certainly, the gain is really about what we know and is definite and what we don't know. And so for instance, cesium and strontium are the initial heat problem in the repository concept.

MR. TAVLARIDES: Sure.

MR. DOBSON: And we know how to vitrify high level waste that contains cesium and strontium. And we know that we can get an incorporation rate of the fission products in the glass that's high. It's in excess of 25 percent and in the early 30 percent. You can actually get more fission products in the glass than that but other things constrain you. So the viscosity of the glass might become too great and so the operation of the facilities becomes different, you know, higher temperature is required and all the rest of it.

So if you can get the cesium and strontium into the glass, and not adversely impact either the glass quality, the durability as the other gentleman asked about, and not impact the through-put, then the question is why on earth would you take them out and have a different waste form to manage?

MR. BOARDMAN: That and the cost of the

separation.

MR. DOBSON: If you can take care of the heat problem just by decay cooling the glass in a store the sits there, doesn't actually need attention because it's passive cooled and provided that fresh air is available, you've taken care of the heat problem.

VICE CHAIR CROFF: Okay, thanks. John, do you have any questions?

MR. FLACK: I know we're running out of time so I'd just like to ask one question about the burner reactor side of things. DOE is of course, moving towards sodium metal-cooled reactors. Do you see that technology as a technology for use or do you think something like fast gas reactors or some other technology would be more suitable for this process?

MR. DOBSON: I'm actually unable to -- you know, I really don't know enough about that to answer that question.

MR. BOARDMAN: I think -- I just have a view that I'm not clear on the down select process that was used to arrive at a liquid metal reactor. So I still have a question about how that decision was arrived at and what the selection criteria and so on that was fed into that decision. I just don't know.

MR. FLACK: Okay, thanks.

VICE CHAIR CROFF: Okay, thank you very much. A very interesting presentation and appreciate the answer to all the questions. There could be 1,000 more but I think we need to move on. What we're going to do here is take a break until 3:20 and we're going to have a roundtable discussion and the roundtable participants, I hope, you know, who you are, if you'd come forward and we'll get you seated up here at the table. Thank you.

(A brief recess was taken.)

CHAIR RYAN: It's all yours.

ACNW&M WHITE PAPER ON SPENT NUCLEAR FUEL RECYCLE FACILITIES

VICE CHAIR CROFF: Welcome back. This portion of the afternoon session on fuel recycle is going to focus on the fuel recycle white paper being developed by the committee, the committee staff, and some consultants.

The draft of the paper has been posted in ADAMS, and is undergoing external - meaning outside the NRC - review. The deadline for written comments is the end of this month.

For those of you who haven't accessed it, back on a shelf some place here is a copy of an email containing a URL which will directly link you to the files so you can download them, and you don't have to experience the joy of searching in ADAMS.

The goal of this session is first of all to summarize the parts of the white paper that have been substantially expanded or where things have changed since the last briefing to the committee on this subject which was in the November 2006 meeting.

The briefing is going to be done by Dr. John Flack of the committee staff who is sitting up here in front. And then Dr. Ray Wymer over here on my right who is a consultant to the committee.

Also in attendance is Professor Larry Tavlarides, who is right back here. He is a consultant working on the paper. And another consultant having contributed significantly to the paper is Howard Larson who is not here today.

After the presentations we're going to have a roundtable discussion to obtain input from some key stakeholders seated at the table. And I'd like to sort of go around the table and introduce them right now.

First up here we have Alan Dobson and Colin Boardman who you've heard from for the last couple of hours. Dan Stout from the Department of

Energy, DOE nuclear energy. Going back over here, Mike Norato and Amy Snyder, both from NMSS here in the NRC.

Phil Read from research, and from Areva, Dorothy Davidson, and Alan Hanson.

So those will be our roundtable participants.

After hearing the presentations I'm going to invite each of the roundtable participants to offer some input on fuel recycling in general or on the white paper or on things you might like to see or suggest we consider for inclusion in an AC&W letter.

We expect in September to be writing a letter to the commission, giving them our thoughts on fuel recycle, and transmitting the white paper. That is our goal at least.

And of course the advice to them is on regulation, on the regulatory aspects of fuel cycle, and what we think the NRC should or should not be doing in that regard, and when.

Following going around the table it's going to be followed by a sort of a fairly standard Q&A session, which turn almost into a free for all, given the energy I sense for this issue. But that is what we are going to do after hearing your remarks.

And finally, assuming we haven't run too long, we will take some brief remarks from the audience.

Before going into the briefings I've got a few comments on the paper, for the purposes of focusing the discussion and keeping us on the right things.

First, the focus of the white paper is spent nuclear fuel recycle, which has become our shorthand for aqueous spent nuclear fuel reprocessing and refabrication of fuels using conventional processes involving powders.

The purposes of the paper are knowledge management, that is, to capture the thoughts of a dwindling pool of expertise on fuel recycle, and to provide on technical basis for the committee's recommendations to the commission on the regulation of these facilities.

The paper will not contain conclusions or recommendations - those will be reserved for the letter. Additionally, to make it clear, neither the paper nor the letter will evaluate the merits of ongoing recycle development and implementation programs or policy issues.

We recognize the need to improve a number of presentation related aspects in the paper including an expanded statement of purpose and context at the front and executive summary, and switching to a more conventional numbering system amongst other things.

I suggest the discussion not focus on these more mundane aspects and stick to matters of substance.

I am going to request that the committee try to hold their questions until we get through both the presentations and go along the table and hear the thoughts, if you can restrain yourself.

With that, John, take it away.

MR. FLACK: Okay. I'll reemphasize, I'll make this very brief, since this outline to frame the discussions that are to take place. And some of these things have already been mentioned by Alan, why we are doing the white paper.

Actually the purpose stems from a commission SRM that came down through committee back in 2006 that requested that the committee become conformed and in a position that would be able to advise the commission should DOE go ahead with reprocessing as a new initiative.

And so that SRM had led to the development of what you will hear today about the white paper.

And the white paper was just to do that, to be able to put together the information that will allow the committee to come up to speed more or less on the area of recycle.

The paper itself serves three objectives, and Alan touched upon these. It looks at the past, it tends to look to the past to capture previous experience in the field, to try to get that also as part of the knowledge management initiative of the agency.

So it looks at the past. It's going to touch upon the present, and how that experience has led to where we are today, and what is going on today.

And then also, the last bullet being looking into the future, what challenges does this present to the commission, and how this would all tie to the regulators.

Basically very simply the way I look at the regulatory framework is there are really three major pieces to it. There is of course the commission policies that are out there. There have been a number of policies that were written over the years, but they were primarily related to reactors. We have like advanced reactor policy statement, a safety belt policy statement, a severe accident policy statement.

Very little in the way of recycling, reprocessing, since it has been mostly reactor activities over these years.

But policies are global in nature. The staff generally goes to the commission and asks for some guidance on how to do something, and the commission gives that in the form of policies.

But we are not really hear at this point looking at what the commission's policies are, but we recognize that a number of policies is likely to evolve during the course of these initiatives.

The second big piece of course is the regulations themselves, and that is the rules, reg guides, standard review plans, inspection guidance that implements those policies or is consistent with those policies.

I should mention there is one policy though that is generic to both reactors and reprocessing, and that is the PRA Policy Statement, which is required, which is the policy of the commission to use PRA for risk insights into decision making process. So that's one policy.

And then of course the supporting infrastructure is important as well, and that is, how do we carry ou8t and implement these regulations. So you will be primarily hearing much of the paper, or I look to see much of the paper focusing on the rules and regulations, and to some extent, how that will be supported through some infrastructure.

The areas of interest, you have heard a lot of these today already. There are really four major areas: safety and security of course the primary concerns of the commission in its design and operation, and design meaning also decommissioning and how that is thought about in the decision.

Proliferation is something that will have to be dealt with at some point.

And then the last two, the waste forms and classifications, and then the effluents and environmental impact, is certainly dominant, in the dominant thinking right now of where we are going.

Since that time back since the SRM has been written, a number of SRMs actually did come down to the staff that mentions the ACNW as well as the ACRS in their involvements in supporting the staff in recycle.

The staff and Amy Snyder here of course is one of the authors of this paper - I should say a commission paper that had gone up recently in May - and this was in response to an earlier SRM by the commission that requested the staff outline options for licensing the GNEP facilities.

The response to that has indicated that there were really four approaches that the staff had proposed in doing this or making the regulations of licensing, reprocessing GNEP facilities.

The first one essentially would revise Part 50 and Part 70 which would be simply taking the regulations as we have them today, improving them and making them useable for licensing these facilities.

The second option proposed was to use a revised Part 50 to Part 70 within the context of reprocessing, but to also add a separate part which would deal with the burner reactor, and they call that 5X.

And certainly Amy will be directing for as they long as they project.

The third option was development of a new - a whole new regulation for the GNEP facilities, and fourth option of course would be to issue a commission order.

Each of these have a certain number of pros and cons, and that was articulated very well in the commission paper.

The staff also proposed a two-phase

approach to this process, to making those regulations amenable to licensing recycled facilities as well as the burner reactor.

The first phase would be to first develop a technical basis document to support the Part 70 rulemaking, and form a Part 50 GAP analysis. Which means basically that you look at what the regulations are today, you look at where they would need to be if you were to use them to license these facilities, and then you look at what you will need to do to fill the gap in going from today to that envisioned regulatory process.

And phase two then would be after doing this exercise, you might say, phase two would be then to move towards preparing a rule just for the GNEP facilities.

So the commission recently responded an SRM back to the staff on these options. They approved the phase one option one approach; that is, to go back - well, to look to develop the technical basis document, the changes that would need to take place in Part 70 and Part 50; do the GAP analysis; and then prepare the recommendations to the commission based on that work.

But that's as far as the staff should go at this time.

The second piece would be after the DOE decision that is expected to come in June of next year. And in that decision it will define DOE's plans in moving forward with GNEP.

So at this point in time, looking at the SRM, there are really - I guess there are three SECYs that are coming out - correct me if I'm wrong, Amy. The first of course is to go back to the commission with a plan on how you would do the gap analysis and the technical basis document.

Then the second SECY would have a recommendation as to how to proceed with rulemaking activity.

And then third would be the rulemaking plan. Is that the way I can see it now?

MS. SNYDER: It would be more or less, yes.

MR. FLACK: So of course the decision in May of next year could make or break, or change, whatever the approach might be.

Okay. So as Alan had mentioned, we have distributed the white paper for comment internally. We did it in two steps. We first circulated it amongst the NRC for comments. And then following a review of their comments, going out to external stakeholders which is here today.

So from the internal stakeholders, these were just the internal stakeholders' comments, we received about 80 comments from the three offices, NMSS, FSME, and research.

And basically there were three bins for those comments. One bin was technical/regulatory. The second was scope. And the third was basically comments related to the structure and format of the report.

We are really focusing on the first set of comments, and to some extent the scope as well, to see what else could be accommodated with the report at this time.

Overall we had very positive feedback on the paper in general, and many saw the value in the paper in providing information to be thinking about while they move forward in this area.

Some example comments, and I just put down pretty much what we thought at the time to be the most significant comments, and some of them having to do with scope. That is, to expand the paper to capture more on accidents and incidents that have occurred at facilities, both in this country in the past, way past, and international facilities; to talk more about lessons learned from international experience. We plan to actually visit a facility next year, so this is more of work in progress as well to capture some of those insights.

Third, implications of recycling and waste specification system. Quite a bit has been said already but certainly, again, more could be said, maybe as far as we could go with understanding what the plans are for DOE, and what technologies they will be using will certainly have an impact on that.

The fourth is pretty much to continue to link NRC's regulatory process as we move forward, as we establish a path forward, there is quite a bit in the paper. Each time you read something, you could think about, well, what does that mean in the context of regulations. And there could be more put in on that.

And finally research needs for industry and NRC, and some of this has been mentioned recently in a letter from the committee to the staff on long term research plans, where we tried to articulate some of that need for the staff anyway.

So these were some of the example comments that came in from out of the internal period of the document.

Okay, so that leads us to the roundtable discussion. When we sent out a request for stakeholders to come, to bring comments in, as this roundtable, there were really five questions that we asked. I'm sure there's many more that could be brought up, but five at the time we could think of.

The first one of course looks at the past and is asking the question whether or not the history of recycle has been adequately captured by the paper.

The second one is more or less on the status of where it puts us today, and how that is represented in the paper.

And then the last three are really the key to moving forward. We identify the important issues. How we identify the important options for moving forward from regulatory perspective again.

And are there any additional improvements to the document that could help enhance the licensing or regulatory processing.

So before my voice runs out, that in effect concludes the opening remark, the kind of frame of where we are heading.

If there are no questions, I'll turn it over.

VICE CHAIR CROFF: Let's keep going for

right now.

Ray?

While Ray is making his way up I'll offer one item on the comment resolution. The external review draft that everybody has in hand and is looking at right now does not reflect resolution of all of the internal comments. Some would just take too much time, or were very complicated, and so we are still working on some of these.

MR. BOARDMAN: Just a quick question. Is there if you will a cutoff date by which you won't receive comments?

VICE CHAIR CROFF: Written comments by the end of this month.

Ray.

MR. WYMER: I'd like to open by thanking the people here on the NRC staff who responded to our request for a review of the paper. There were a bunch of excellent suggestions made or comments made. We tried to respond to all of them. We couldn't probably handle all of them as well as we might have.

But nonetheless, I was impressed by the level of expertise that was exhibited by the kind of comments that were made. It was a higher level than I thought still existed after a 25 year hiatus in the reprocessing business. So thank you very much for what you have done.

These are the topics that we covered in the white paper: we presented a fuel recycle overview, and presented an historical overview of the fuel recycling facilities, the siting, design, operation.

Of the current international recycling activities, of which there are quite a few and significant, and let's start right into it.

What we've done is listed, toward the end of the paper, a bunch of what we thought were recycle facilities licensing issues that we thought might provide the basis for the ACWM to frame letters that they might write to the commission with respect to reprocessing and fuel recycle in general.

And first of all, the selection of licensing regulations, that was discussed in general terms briefly just a minute ago by John, John Flack. And the facilities for which new or modified regulations may be required.

And these include reprocessing itself, fabrication of the transmutation reactor fuel, that is, the actinides that are going to be burned up in a fast burner reactor; and the different kinds of waste storage - I call it extended waste storage because they are beyond the kinds of wastes that have traditionally stored at reprocessing plants.

So these are some of the early issues. As John said, the existing regulations were designed primarily for LWRs, or for facilities handling, small amounts of radioactivity; nothing like the fission products and the amount of actinides that would come out of reprocessing plants, and any fuel fabrication plants, perhaps the NOX plant down at Savannah River.

So specific important considerations that might come up are whether or not the regulations should be deterministic or probabilistic. And that's fairly important, you said Rich, because there is a large cost factor involved. It's more difficult to do a probabilistic analysis. And it's only really justified if it's a very complex large plant and a lot of complications involved. Otherwise the deterministic are a reasonable way to proceed it seemed to us.

Also the analysis of the options available were whether or not to use a conservative data and model approach, or whether to use best estimates data and uncertainty analyses. Again this depends on the specific nature of the facility, and just how complex it is, and whether or not the time and effort required to do the extensive analysis is really worthwhile. So this is something that needs to be addressed.

And then there is the issue of risk-informed performance based considerations. Risk informed really means that you should take into account the considerations of risk, but they aren't controlling necessarily. There are other considerations such as cost, that should be brought to bear on whether or not you - how much you go into the risk informed aspect of it.

Also, performance based, that means that you should look at the performance of the facility. But it isn't just the performance that you take into consideration. It is performance based, but that is not the whole consideration that is involved.

And then finally the single or multiple facility licensing, you could write a license for a reprocessing plant, and a refabrication plant all on the same site, or you could split those up into separate licensing activities. And this is not an easy question to be answered. And it's another issue that should be taken up by the ACNW.

I know I'm rushing through these, but we'll have to have some time for discussion.

Then there is the impact of facilities and operations on the regulations. The uranium in this case will contain some contaminants, and whether or not you can put them back into an enrichment plant, or whether or not they could be disposed of near the surface depends entirely on how the process runs and how clean the product is, and that remains to be determined as more results are in on the process, and the operations are carried out.

So there is a question of the measure process of stream is uranium, and just exactly what can you do with it. The gaseous effluent control limits are needed. About the only two that are indicated to date are that iodine should be recovered at 95 percent and krypton about 90 percent I think, krypton 85.

These are - this leaves unspecified the carbon 14 as carbon dioxide that comes off, and the tritium that will come off the plant. Whether or not these need to be managed, contained, is an issue that needs to be addressed. We don't propose to answer that question; merely to point out that it's an issue.

Then degraded class C low level waste is a problem. There is now as I understand it a method for handling of interim on the - in the independent central storage installation, but that does not in anyway address the nature of the waste form, or the manner of ultimate disposal for the class C waste.

So that is an issue that will have to be addressed.

In addition the UREX + 1a process, which is the one that currently is being focused on by the Department of Energy, for the reprocessing of spent nuclear fuel has a number of unique waste management and operations issues.

The spent fuel hardware contains Technicium, and will contain probably some iodine as palladium, iodine.

And so that will be a special issue with respect to disposing of the hardware, and the empties and so on.

These are separate cesium 137 and strontium 90. Then the question is, how do you store them, in what form, and how do you ultimately dispose of them?

My personal view coincides with what I heard this morning, namely, that you don't separate them from the rest of the fission product that you dispose of along with them.

But that is not the current UREX + 1a process which separates out cesium and strontium for independent management.

Then there is the non-high level pure waste, Class C, less than 100 nanocuries per gram, which is another special type of waste.

And there are other kinds of waste that will lower activity that will come out of the process. There might be such things as fuel extraction reagent cleanup, the waste from that.

We heard this morning that there will be no waste extractants in the process that are being discussed now, but that there will be cleanup waste from cleaning up the solvent, and those must e handled in some way, an issue that must be addressed.

In addition the reprocessing plant as we see it has many separations processes, and this will I think substantially complicate the NRC review of the UREX systems, because it isn't just a single UREX process; it's a whole bunch of processes, four separate processes which strikes me as a very complex process and one that will require a lot of careful review and equipment that has to operate in series, which means it's going to be a carry over from one process to the next, which will result in some cross contamination. This has to be addressed.

And when you get to moving the analyses of your various processes and waste streams to your process control lab, there will be additional rather difficult analyses that must be carried out that are not currently required in the present PUREX processing. These will have to be examined in some detail.

Well, there is a real question I think of effort waiting since the 1970s until 2010, `12, `15 of whether or not the capability exists within the NRC to independently review and validate the safety and performance features of a reprocessing plant as complex as being proposed. The availability of qualified staff and support contractors is an issue that is important and has to be looked at fairly carefully.

Then if the NRC decides that they must validate certain key process steps, then they may need hot cells to do this in, and that is not part of the present composition of the Nuclear Regulatory Commission, so they would have to go outside somewhere and find hot cells of competent people to operate the hot cells to validate the key process steps that they determine are essential.

There is a real question of getting plant operators for this complex plant, and there will -

they will not be available . That crop has died and retired, and they are no longer up there in industry. And so they will have to be trained, and they will have to ensure that the operators are competent by giving them examinations. They will have to prepare the examinations. They will have to give the examinations. And that requires that the NRC staff be capable of providing the confidence to do these tasks.

There is another broader issue that needs to be resolved sooner or later. When you are looking for losses of material, and this relates probably to safeguards and proliferation, there are different requirements by different agencies of what the losses - the accuracy measurement of losses can be. And you can see here, the IAEA says that you should determine if the lesser of 2.42 kilograms of plutonium. The NRC says less than one-tenth of one percent of the active inventory, and DOE says less than - well, these are major, you know, factors of ten are significant. And so somebody needs to try to get some resolution of this issue some place along the line.

Then there is the issue of designing with decommissioning in mind. This is a nontrivial thing. I think that the commission probably - I don't know for sure - but probably does not have the expertise in house to look at the design of a reprocessing plant and decide whether or not it addresses the issue of decommissioning, so that it's done in a practical cost-effective way.

And there are a number of regulations out there, but regulations don't provide people who are capable of looking at a design and deciding whether or not it's adequate. But somehow or other, either by getting in house expertise, or by contracting groups to come and look at the design, they will have to satisfy themselves that this is an important, I think an important NRC requirement for design the plant with decommissioning in mind is in fact met.

There are some research needs. There is a lot of - this was alluded to earlier - a lot of safeguards and other instrumentation available. There is a cutting edge that is not incorporated in existing plants, but it's out there. And it should be looked at carefully to see whether or not it needs to be incorporated, to get the kind of accuracy that you need in measurements, and to make sure that the accuracy required for material accountability, like for example these signal ID requirements, can in fact be met.

And then I think there is a fair amount of research required to determine what the forum of the - if in fact you separate cesium and strontium separately, for storage, what the form of the waste should be. Because cesium for example does not have a very good stable waste form. It's too easy to dissolve almost anything you can think of.

The same thing is true of iodine 129, there really is no really good chemically stable form of iodine, no compound that is truly highly stable. So it has to be bound up in something so this waste form will require a lot of attention.

And krypton 85 of course is a noble gas, while under extreme conditions you can make compounds that are stable with krypton, they tend to explode. And so the issue of binding the krypton, things like sputtering it to metals, or tank storage, because it is a relatively short half life, that needs to be looked at.

And then carbon 14, of course, it can - it will come off dissolved as carbon dioxide, and trap it into a caustic solution and dry it to a solid, and make calcium carbonate or some such thing. But it needs to be demonstrated.

And there needs to be a careful look taken on how you in fact do trap krypton 85, krypton I think not so much on the carbon 14. What process do you use? If it's krypton, it's usually a very low temperature process, where you see if you can catch it in a very low temperature liquid.

Tritium similarly has to be trapped in some way, preferably before it gets into the water in the dissolution step so you can drive it off in advance.

And then the impact of trace species on safety for example, actinides, as it winds up in various parts of the reprocessing plant. As more information is gained on where these small amounts of actinides go, then there must be research on how to remove them, how to handle them.

Finally, another big issue is timing. As you know DOE has said said they will make a decision in June of 2008 on how and whether to proceed with GNEP. This drives a NRC licensing process application very hard, and it's not at all clear that it could be done - what DOE has in mind.

But it's not at all clear on the other hand that DOE will proceed on the schedule that they had in mind with the kind of funding that they are getting and expect to get.

And finally the standards will require

time to prepare. Although there is a note here at the bottom, one is already underway. But these are very time consuming operations.

And that's it. I hope it wasn't so fast that you couldn't understand it.

VICE CHAIR CROFF: Okay, that brings us up to the roundtable.

MR. WYMER: We'll just leave that up there for a second. We may have to resort to that backup slide. We'll see what happens.

I'd like to note one thing. When Ray was talking through, he dropped a nine at one point. The iodine recovery implied by the EPA standard is 99-1/2 percent, which is a pretty stiff number.

VICE CHAIR CROFF: With that, I hope I've given enough background so you have almost a clear field here. And I'm just going to start off on the far left with the folks from Areva, whichever one of you wants to leap into the fray and provide your thoughts on the questions you were sent, the white paper, some of the issues you have seen up here.

MR. HANSON: Okay, well, I guess I can start off then.

I'll start with something really quite straightforward. I want to concur with Ray Wymer's comments and also those earlier by Colin Boardman. At Areva we see no advantage from a waste management from an environmental or safety point of view, separating out and segregating the cesium and strontium.

Cesium and strontium, the management of these particular isotopes is going to be done by decay regardless of whether it's done in glass, separate, or in the repository.

That being the case we can't see any good reason why someone would bother to separate them out, and when we look at the solution problems with cesium, and the biological activity of it, we believe it's better to keep it in very dilute form in the glass.

There is one other comment that I would like to make with regard to the previous presentation, and that was with regard to uranium. Yes, there is going to be some contamination in the reprocessed recovered uranium.

And historically this has been a problem with regard to reenrichment because the gaseous diffusion process is one that is very unforgiving of contaminants, so when you run that through your plant, you tend to contaminate the entire facility.

However by the time that we are doing the GNEP facilities or are recycling this country will be operating gaseous - not gaseous diffusion but gas centrifuge, and centrifuges are far more forgiving. It's very simple to set up a separate line and cascade to deal with the reprocessed uranium so that you can isolate the contaminants in a small part of the plant and deal with them in that particular fashion. So I don't think this will be a problem in the future.

And then finally just to keep things short, with regard to the regulatory process which is the focus, the processes we have in place right now are in our view reasonably workable as they are. They may not be optimum, but they can be used. And I think the mixed oxide fuel fabrication facility in South Carolina, and that licensing process is a good example of that. Obviously the Part 70 regulations were not written for this type of facility. But the process worked in our view exceedingly well. And what that tells us is that Part 70 can work very well on the fuel fabrication piece.

With regard to the burner reactors, modifications of Part 50 probably would be necessary depending on the type of reactors that we are dealing with.

In this particular case, historically licensing of reactors has been done on a deterministic basis and a maximum credible accident basis, and I would expect to see something quite similar for the burner reactors.

That would leave the treatment, the recycling plant, the reprocessing plant, and how that is to be regulated. And that unfortunately is a bit of an orphan, because we have not licensed one in the United States now for decades.

And so it would be necessary to create a new part of the regulations for this. Whether that is in Part 50, Part 70, or some other area is probably up to the commission to decide. But given the good experience we've had with regulating under Part 70, it would seem that one good option would be a new subpart in 70 to deal specifically with separation facilities.

VICE CHAIR CROFF: Thanks. Phil.

MR. REED: It was nice to see many of the comments that at least research expressed were included in the slides, and in the discussion that Dr. Wymer presented, particularly with regard to research activities.

A couple of comments I wanted to make was, first of all, in your review of the boron literature, and situations at some of the other operating plants, I think it would be nice to include routine releases from radioactive materials as well.

We have seen some papers with iodine 129 releases, but we are not sure whether or not they are part of the overall processes.

But we would certainly like you to include accident as well as routine releases. I think that's a very good point of a lot to be gained, I think, by the lessons learned from some of the foreign plants.

This issue of going from small scale to large scale. It probably is not an issue for Thorp or from Areva, but since we are going to discuss a very brand new process, the process, the UREX + 1a, the tendency is to think that you can go directly from a small laboratory scale to full scale. And I know you addressed several sentences in your paper about that. But perhaps you might want to include a little bit more about how testing may be done, should we go to a larger scale facility, how much testing should be done.

There are a lot of problems that you find when you go to fullscale that you really don't see in the laboratory. That was one thing that might be expanded on.

The third thing was this issue of waste. It's still not clear even from reading the regulations, even the Nuclear Waste Policy Act, and then 10 CFR Part 61 or Part 63 whether or not any of the waste that is actually produced can actually go into a low level waste facility.

Transuranics, for example, if they come from a nuclear power plant reactor that is currently operating, yes, they can go in there. That same transuranic is produced from a reprocessing facility, it's not clear whether that actually go in with commercial wastes. Simply because the wastes are defined not by activity but by origin.

So that creates kind of thinking. Can we actually have greater than Class C waste for example? Does it all have to go to high level waste?

I don't think these things have actually been thought through, even from a regulatory perspective, whether or not some of that waste can actually to low level waste.

Commercial low level wastes are specifically designed for commercial facilities. So I just want to leave that as an idea.

I think the other thing that might enhance the paper would be to include a lot more description of the chemical processes, chemical reactions or chemical stochiometry of the ULEX + 1a. It certainly is new. And most people are familiar with the ULEX process, which by the way I think you did a very good job in going through all that. It seemed to be pretty good.

But in new processes it's not very clear exactly what we are talking about. I don't think most people are familiar with scrubs or these terms where we remove components and things like that.

So perhaps because we are dealing with something that is very new, it would be useful to include the chemical processes, particularly decontamination factors.

And where this particularly has a great concern is in the regulatory process when we do risk analysis, and if we have to do criticality analysis. If something goes wrong in the system, and you actually want to know what point in time you are in the reprocessing part, and for that you need to know exactly what the chemical systems are, and things like that.

And finally I'll touch on something that came up in our NRC's RIC conference. There was a paper presented by GE which talked about the pyroprocessing end. And I thought you might want to give a few seconds

MR. WYMER: It has already been included.

MR. REED: It's already been included? You updated on that? Okay, fine.

MR. WYMER: We responded to your -

mR. REED: Oh, did you? Okay, well, that's good then. And I think that is about all I had to say. I thought your paper was very well put together. It was very timely.

I even liked that sample problem that you went through. I thought that was very good at least for an introduction part. It did sort of by some of the processes, it indicated some of the complexities that are going to be involved.

So thank you.

VICE CHAIR CROFF: Thanks.

MS. SNYDER: Well, the draft report provides a very good overview of the fuel recycle and fabrication program's technology and facilities.

However, we noted that it emphasizes a 30-year-old U.S. experience, and it only briefly touched on the experience in Europe. So recent experience specifically on design process, waste storage, emissions and lessons learned could significantly add to our understanding of the regulation of recycled facilities.

One of the comments DOE made at our fuel cycle information exchange, one of the presentations they made, they said that the majority of the processes will not be new or advanced, based on their discussions with the industry.

And the selection of technology is key to developing the licensing framework for GNEP. And since DOE has not yet selected a technology it's really too soon to tell if all the key regulatory and technical issues have been identified.

And at present, from what we do understand, the potential areas of concern are: waste management; effluent management safeguards; potential interdependency of facilities as it impacts on regulations; and by that I mean for example reactor safety goals and how that might impact colocation of facilities; and also fuel qualification, and what fuel - what materials and fuel issues may have an impact on reactor operations.

So these were the things that we need to have more understanding on. But we are going to continue to develop per the commission's directive to work and engage other offices within the NRC, the ACRS and ACWM and industry in this important endeavor.

VICE CHAIR CROFF: Thank yo.

Dan?

MR. STOUT: Overall it's a really good product for the purpose of creating a foundation of knowledge capture. You can see how it will be very useful as a tool for many applications, in terms of educating new staff, in terms of a building block for training programs.

We will be providing line by line specific comments by the 27th, minor editorial, minor correction type comments separately.

And one of the disadvantages of being further down the line, some of it is repetitive. But we suggest less Barnwell and more operational commercial facilities. And particularly looking in France and UK and Japan and gather more information from those.

There is an opportunity for the NRC to work with DOE regulatory folks. DOE does have a knowledge base of regulating facilities in the United States that deal with reprocessing and fast reactors. There is just an opportunity there to tap that knowledge base.

Likewise internationally, suggest that you take advantage of your colleagues in internationally that have the same experience.

And last I guess I'll emphasize this is a good opportunity to capture a lot of lessons learned and get them on paper, so there would be value in that.

And I guess Phil teed it up, Amy addressed it somewhat, but DOE has not selected ULEX + 1a as a technology. And DOE has not said it is going to go build a 3,000 metric ton ULEX plant.

And as Amy pointed out, and as the fuel cycle information exchange presentation and elsewhere you know, there is a balance as you look at the different variety of technologies that could be deployed. And if you are going to build something that is very much like what is in existence today, you can build big today.

And if you are going to build something that is very new, and requires a lot of research and development, then it needs to progress through the logical steps of engineering development, demonstration, and deploy small and grow.

So DOE envisions an evolutionary approach to deployment. It doesn't have to all be accomplished in one step.

So DOE is in the process of engaging with industry. There was a funding opportunity announcement that went out in May. Applications were received. They are under evaluation, and in a nutshell DOE anticipates having industry on board by September, and their work will help inform the process and the decision making that will take place feeding into the secretary's decision in 2008.

Okay.

VICE CHAIR CROFF: Thanks.

Who is going to -

MR. BOARDMAN: I have just a few comments.

First, I would generally concur with Allen`s comments earlier on the regulatory aspect. We thought about the regulatory aspects in three blocks basically: the reprocessing block; the fuel fabrication block; block for all new types of fuel.

And indeed maybe a new type of reactor.

So we have sort of concluded that there really does need to be a new regulation for the reprocessing facility, whether that is a sort of a use of Part 70 or something else.

We think that Part 70 updated in the right way would probably be workable for a fuel fabrication facility. And right now because of uncertainties about the type of reactor, we haven't really made up our mind about whether the existing regulations for reactors would be appropriate to update, or whether we would recommend not messing them out with those and taking a somewhat new approach.

So I guess the only solid piece of that that we think Part 70 is workable for the fuel aspects but we probably need something new for the recycle aspects, because it is quite a different type of facility, a radiochemical plant which hasn't been licensed in probably 30 years or more.

So that is the first thing. The second point I guess both Phil and Amy brought up something alluding to this, in the end the devil is in the detail, and at this level of dialogue it is easy for us in the commercial world to talk about what we might want to do.

What we are very reticent to do is to talk about how we do it, because in the end it will be proprietary and commercially sensitive.

So whilst we agree with Areva on a lot of things, including what we might do with cesium and strontium, the way we go about things is somewhat quite different.

So I'd like to link that to a point Dan just made, and something I read I think last week or this week that there is now at least a cemented relationship between - a formal relationship between DOE and NRC.

And not specific to the white paper, bu9t as this moves forward I'd encourage the two organizations to find a way of involving NRC in these industry studies that will start in September and October time.

In a way which provides a mechanism for the sorts of confidential information that will make it easier for people to understand more about the specifics of ULEX, NEWEX, COEX and so on, in a confidential way.

And so that's less about the paper, and more to do with setting up the right sort of relationships.

I think that is all for me.

MR. DIAS: I have just one point to add.

Deterministic, it's really a question, the deterministic versus probabilistic.

I absolutely agree that the analysis when done on a deterministic basis is simpler and more effective. But there can also be a significant cost impact using that approach on the facilities that need not be taken, you know, because in order to get to the absolute deterministic state may require things that are harder to engineer.

It's just an observation, and maybe it needs like a sidebar discussion with you on that deterministic versus probabilistic statement.

VICE CHAIR CROFF: Okay, we have been around once.

To address a couple of points I heard around the table. In many of the NRC comments that was a fairly pervasive call to expand international experience, what has been going on over there. And we have heard that. That was one of the comments; it just takes awhile to gather that much information. But we heard that, and we are working on it.

Regarding what Phil said on the decontamination factors, and the internal streams, we actually tried to do some of that. And unfortunately it was a casualty of sensitive information.

When you get to that level of detail on stream compositions inside the plant it starts to become sensitive.

So ultimately we were given a choice to either not have a public white paper or to not put that information in. So the choice we made is to go with the public white paper. It wasn't an easy choice, and it wasn't one we wanted to make, but that's what we were left with.

On the mention of ULEX + 1a, I think the fairest statement is, that's what most of the information we could lay our hands on addresses so that's what we addressed.

But to the extent possible and as we go forward over the next couple of months, we are going to try to make the paper somewhat more generic. Because programs come and programs go, and to make it maybe a little bit less GNEP centric and a little bit more recycle centric, if you will, a little more general recycle, because we don't know what decision is going to be made in June, where it is going to go. So that is where we are going to try to head.

With those brief explanations, I think it's time to turn to the questions. And I guess first let me start with the committee and their consultants.

And what I'm going to do is start going around and allow each of you one question each, and none of this multiple part trick.

(Laughter)

DR. CLARKE: I actually am going to pass.

VICE CHAIR CROFF: Okay, and we will keep going around until we run out of time or we run out of questions.

MR. WYMER: You mean questions and comments, don't you?

VICE CHAIR CROFF: Questions and comments, yes.

And I'm going to include our roundtable members in this. So we'll get you in, and if you want to ask questions, go ahead and try and do it.

Ruth.

DR. WEINER: I only have one.

Really I'd like to come back to the question of an advantage of separating out the strontium and cesium. Admittedly there are some disadvantages. But what we always thought was, well, the 30-year half life, you can store or dispose of in a different way. You don't have to worry about geologic disposal. You don't have to worry about thousands of years, or hundreds of thousands of years.

And that seemed to me to be simplistic about it. The primary advantage of separating out the - of a waste form that - of radionuclides that contains fission products that have relatively short half lives, that you can store them on the surface. You are not concerned - the waste disposal is a simpler problem.

And I'd like to get comments on that.

Since you made the comment that you didn't see any advantage, let's go with that.

MR. HANSON: Okay, well, I'll start, and I'm sure there will be several other people around the table who have some thoughts on it as well.

I want to come back to the fundamental approach to dealing with these two isotopes. No matter whether they are separated; whether they are in the spent fuel; whether they are in the glass, they are not going to go underground and heat up the repository.

So we are dealing with surface storage or near surface storage for some period of time.

To my mind looking at the management of the repository, we are probably going to be doing the same thing with the glass logs. So keeping the two of them together in that regard makes a good deal of sense. It makes the short term heat problem much simpler, and now we are reduced to dealing with a long term heat problem.

And of course that is an actinide problem. We will have to deal with that separately.

More importantly, if you look at the ULEX + 1a, or whatever, what you want, it is not a process; it is a suite of processes. And every one of those processes has a different solvent. It has a different separation factor. It produces a different set of waste streams. It's got different sets of handling with the output.

From a very simplistic point of view, four solvents, four separations, four times the cost. Now that is way oversimplified, but there is a certain amount of truth in that.

So before you start adding on a new separations process, you have to ask yourself, you are going to pay a lot to do this; what are you going to get for it? If you don't get something in the repository design, then you have gained nothing and you have just added to the cost.

MR. DIAS: I would - can I just add to that?

I didn't go to the question of different solvents. But the actual approach that was being formulated when we first looked at cesium separation was to actually use a heavier than water solvent. And to anyone that has operated solvent extraction facilities, they will immediately understand the operational, the operable difficulties that that could lead to.

So for instance how would you skim off the solvent? Because it's at the bottom of the tank; not the top.

The real issue for me, the repository heating is the major driver. That was the major driver. It's not a waste management issue for separating cesium and strontium.

And to solve the repository initial heat burden, the idea is, well, let's take the cesium out. We can do it. Everybody knows that.

But if you put it in the glass, you can manage the problem by decay, heat, by delay storage before you put the glass in the repository.

You could still put it in the repository and run the fans and cool the repository in exactly the same way. But you have lost the advantage.

Now there are disadvantages in our opinion, and it's clear that Areva share those, and I'm sure others do. But you've taken the cesium from a waste medium which is approved and established and very, very well researched.

The borocilic glass medium, people have selected a single medium. You could tailor that glass if you wished. But my recollection is that cesium was not - it's an important factor, you have to make sure you have the right formulation in the waste, so I don't want to minimize that, or imply that it's not an issue.

But provided you choose the right waste formulation of glass, incorporation of cesium is not an issue. There are certain complexes that it's formed, and you can manage those away.

You don't get any additional incorporation by taking the cesium out, so you haven't managed to get more fission products into the glass by not having the cesium there, because there are other factors that come into play.

I mentioned one, the viscosity of the glass becomes too high, and you then have to start burning at much higher temperatures than the 1,000 to 1,100 degrees C that present melting technology uses.

So there is no benefit, and there are some real disadvantages of having the cesium on the surface. I think you mentioned its solubility and all the rest of it.

So you've taken it from a well defined situation, to something that is definitely not defined, and presents additional risk.

MR. BOARDMAN: The only additional comments I'd make, I was going to make a more general comment, but I'd pick on something Alan said. I mean Alan talked simplistically, admittedly, about increasing the cost of every separation step you have. So if you have four steps instead of one, it's four times the cost.

If you add in the uncertainties, based on difficult solvents, glass viscosity and other things, that four times multiplier could be come 10. So the benefits of that separation pretty soon start to get beaten down and eroded.

And our conclusion is, it's just really not worth all of those issues, raising all of those issues, together with the level of complexity in terms of plant operation and control, it's just in English terms daft.

MS. DAVISON: If I could add one more real quick thing on this one, and I'll agree with Alan on this, it isn't the cesium or strontium that is the limiting factor as far as loading the glass; it's actually curium is your loading factor in there.

Cesium and strontium only contributes maybe 10 percent to the glass. So if you took it up, you may get a 10 percent gain as far as volume in the glass is going to repositories.

MR. NORATO: It'S also not entirely clear that the waste form, even after the thermal decay, will be disposable as a low level waste. Where you have cesium 137, you also have cesium 137, which has a half life on the order of 2 million years.

Additionally where you have cesium you also have barium, which I believe is a REPRA listed metal, so you may indeed be dealing with a mixed waste.

CHAIR RYAN: Not maybe. Will be.

MR. REED: I would like to - the analysis for cesium and strontium that we did for the high level waste repository, based on essentially 63,000 megawatt days - or 63,000 megatons for commercial waste. And even at that activity levels, and even if you assume 10 half lives, there is still a considerable amount of heat generated cesium and strontium.

And I think this was emphasized in two slides that Dr. Lindler I think of Oregon presented to the committee back in August or something. He had two slides that represented I think the analysis of both NRC and the DOE impacts on cesium and strontium.

And I think even with the ventilation that would occur within the first 100 years or something, there still is a considerable impact, and that heat impact is considered to be somewhat important.

MR. DIAS: The significant thing, if I could add, I'm sorry, the fans would be turned off after 100 years. I mean that is the key point, and the repository then allows for that.

And that tells you how much time we are dealing with from a heat point of view.

MS. DAVISON: I'm going to play devil's advocate on this and go to the other side. But the one thing that could be - that I think needs to be investigated in the long term is, that we don't think that technically or economically that there is a reason that you need to separate them.

The one concern may be if you are going to keep them stored on site, and you are going to let them site for 100 years, which there are facilities that do that in Europe, the question would be, is there a perception from public opinion. And that is something I haven't looked at.

VICE CHAIR CROFF: Let's move on. Mike, your turn.

CHAIR RYAN: I'd like to if we can get Larry's slide, it doesn't have a number on it. If you could help out that would be great.

There you go. How about Part 61, Part 63, a new part, something to do with wastes. I always like to pick out 6154, the commission has authority to develop alternate systems and waste classification. Upon request or its own initiative.

So I guess - and I'd like to suggest a white paper doesn't address this very fully; we ought to. To me the waste is the tail that wags this dog. I know you've got to design it, and you've got GALS and ULEX and PUREX, whatever it is, and there is going to be a suite of wastes.

But I think sometimes you design the process because you have a waste you can dispose. It's actually the tail of the process, so you don't produce wastes you can't dispose of, mixed waste.

And of course we have this very well organized system of low level waste, true waste, grade and class C waste, high level waste, and all the rest. None of that is risk informed. None of it.

Contact waste, what is that all about? That is a health physics operational criteria for waste classification. It doesn't make any sense at all.

So I'm wondering if this is an opportunity to think more fundamentally in the regulations about waste and how to classify it in a risk informed way.

I know that is a big huge apple I'm

offering you to bite into, but is that something we should talk about in this paper?

MR. REED: The classification issue would essentially fall out and not be an issue, strictly speaking, if all reprocessing waste streams et cetera were not considered to be low level waste.

The energy policy amendment makes that very clear, that a lot of these wastes, since their origin derived from a reprocessing system -

VICE CHAIR CROFF: You're not answering my question. I'm asking a different question.

MR. REED: Yes, I know where you are coming from, but I'm going to come back to that.

VICE CHAIR CROFF: Okay.

MR. REED: So I'm saying, if that is the issue, and if you cannot bury waste from a reprocessing facility, and a commercial low level waste facility, then the reclassification issue would not apply or would be probably a more minor issue.

VICE CHAIR CROFF: Does EPA agree with that on the hazardous side.

MR. REED: I'm saying if. I put a lot of ifs in there.

VICE CHAIR CROFF: That's a big if.

MR. REED: But the issue that the

commission would have I think would be the greater class C part, because the commission have a lot of latitude -

VICE CHAIR CROFF: But that's kind of the ant crawling on the elephant's back.

MS. SNYDER: But I also think that it's a policy issue.

VICE CHAIR CROFF: Absolutely.

MS. SNYDER: And it's not a technical issue.

VICE CHAIR CROFF: Oh, no, it's a technical issue because of the risk informing aspects. None of the waste classifications are risk informed; they just aren't. They are origin and process based definitions.

MS. SNYDER: Right, but the decision to change that is a policy issue.

VICE CHAIR CROFF: Yes, but here is an opportunity to well at least not to address 61 of these. You have to vet whether 61 is capable of a two-tiered system of high and low level waste of dealing with the products of this process, I think.

MS. SNYDER: Well, right now if you interpret it, you can interpret it with the regulations that are on the table now.

VICE CHAIR CROFF: From a practical point, I will make low level waste or high level waste, but I really have to tailor the process to that endpoint.

MS. SNYDER: Unless there is a policy decision change.

VICE CHAIR CROFF: And I think that is a legitimate question for us to at least point out in the white paper.

Do you agree or not?

MR. GIITTER: I'm sorry, I just wanted to intervene.

VICE CHAIR CROFF: Could you tell us who you are?

MR. GIITTER: I'm sorry, I'm Joe Giitter, deputy director of fuel cycle safety and safeguards, thank you. I apologize for being here late. I was at a digital INC commission meeting.

When we were looking at developing the commission paper we looked at all the regulations, the suite of regulations, in CFR that would be touched, that would have to be touched if we had applications for reprocessing facility and an advanced burner reactor.

And Part 63 is certainly one of the regulations that we looked at. And you are absolutely right; you have got two categories, high and low. And that is not consistent with where the rest of the world is.

So that is - I think that is something we would want to look at, if GNEP comes to fruition. I think it makes sense.

VICE CHAIR CROFF: 61 should be on the list too.

MR. GIITTER: I would think so.

CHAIR RYAN: And if you look at just the experience of the two countries here at the table, they have intermediate waste categories. And if they are anywhere close to optimizing the process of reprocessing fuel, it's the way to go.

MR. GIITTER: But that is all part of looking -

CHAIR RYAN: Yes, it's the same.

MR. GIITTER: Right. And that would be part of looking at our entire regulatory infrastructure that would have to be changed if we are going to get applications for a reprocessing facility or an advanced burner reactors.

CHAIR RYAN: There are - I'm not asking for the answer; clearly that's a huge question. But I'm suggesting that the white paper could at least touch on the fact that this is a reasonable thing to think about, and it does raise policy implications.

But if you look at including some revamping of the waste classification system so it is risk informed and so these can be sorted out based on what is in a particular waste, that may not be a bad thing.

Irrespective of the fact that very shortly we will have one class A disposal site in the country for commercial waste; but that's a different question.

Alan, yes? Any thoughts?

MR. BOARDMAN: You will never have a better opportunity to ask the question.

CHAIR RYAN: Sir?

MR. BOARDMAN: I don't think you will have a better opportunity to ask the question than right now.

MR. STOUT: I think clearly realizing the benefits of GNEP is going to require law changes and policy changes. And so you are in a position to provide input on that.

CHAIR RYAN: You know, even DOE, on the DOE side of things, for waste disposal on DOE sites, that is yet again a different system, and low activity waste and other stuff.

VICE CHAIR CROFF: There's one other thing associated with this. We have a two-tier system now, but there is this greater than class C business. In other words, the EIS that I believe is going forward, as far as I know. It's been silent for awhile, but I think they are scoping that out.

But assuming that goes forward, and they establish a disposal site for greater than class C waste, while technically it is low level waste, it's -it handles, or could handle a lot of reprocessing waste, such as cladding.

CHAIR RYAN: One of the technical things that would help move this along is concentration based systems are useful because waste is typically characterized in that way. But it is not dispositive of the risk.

In a very dilute source with lots of activity it could be more significant than a highly concentrate source that in fact was greater than class C.

MS. SNYDER: And that's not specific to GNEP.

CHAIR RYAN: Oh, no, that's the broad issue. So anything that is greater than class C, I mean ophthalmologists use greater than class C sources all the time, and they are exempt from disposal because it's a tiny fraction of a microcurie.

MS. SNYDER: As Joe Giitter said, that is something that we need to look into, the commission asked us to look into the regulatory framework, and we are going to do that.

But it reinvolves the development of the regulatory infrastructure and policy issues.

CHAIR RYAN: And I think it's fair for us to recognize the fact, that's exactly right. There are both policy and regulatory issues.

But if you look at this as an enterprise, GNEP won't create wastes that are maybe not well managed under the card scheme of waste regulations, and that that needs perhaps its own white paper and detailed attention.

I think that is a fair way to comment on it, and then maybe leave it there as a separate question.

MR. REED: Just as a follow up, if you are going to do this, you might also want to address the legislation part. Because while the NRC can change the Part 61 classifications, we can't say much about the wastes that are origin based. That comes from the legislation.

So you might want to - if you are going to include the regulatory part in there, include the Nuclear Waste Policy Act amendments or something. If you can get that changed, the origin part -

CHAIR RYAN: If I could get that changed I'd be doing very well.

(Laughter)

I understand the point that there is a legislative direction as well. So thank you.

VICE CHAIR CROFF: Okay, I'd like to - I think probably this will be directed at NMSS, and this has to do with the technical basis, document gap analysis. Is that exercise to go through that, is that going to be rather narrowly focused on Part 50 and what it takes to get to something that you could use? Or will it be a broader analysis of the basis and gaps for all of the regulations that would affect recycle facilities, everything from security -

MS. SNYDER: It's going to be abroad.

VICE CHAIR CROFF: Okay, everything from soup to nuts.

MS. SNYDER: We will have to look at all of the regulations, and the - for the Part 70 the gap analysis and the technical basis documents for Part 70. But we'll have to look at all of the regulations for the fuel separation, fuel fabrication and the advanced form of reactor.

VICE CHAIR CROFF: Does that extend the waste classification? In other words, the issues we have been kicking around?

MS. SNYDER: Yes. It is, extends to all of those.

VICE CHAIR CROFF: Okay. Then it seems to me one important point is, there is a suggestion that all the waste from reprocessing, all the things that come out of reprocessing that aren't a product might be high level waste.

That is number one, a fairly scary kind of a thing, and number two, it would sort of lead to the question, why - well, there could be some other reasons for doing it. But you take it, make a bunch of waste, and put it all back in repositories. You've got to wonder about some of this.

Joe, did you have a point?

MR. GIITTER: This is Joe Giitter, Fuel Cycle.

I just wanted to add to what Amy said. We would like to do all those things. But we find ourselves in a situation where we are very resource limited right now. Because it appears, because of the

Economy Act, the work we do to develop the technical basis documents for regulation may not be covered under cost reimbursable agreement.

So we have to reprogram those resources within our office. And right now that is going to be a challenge.

So we like to do as much as we can, but I think we are resource constrained. So the timing and the breadth and depth of what we do may be limited initially until we get resources.

MS. SNYDER: And in fact one of the actions that we have to provide the commission is some supplemental information on how we are going to do the gap analysis, and technical basis document.

VICE CHAIR CROFF: Okay. Bill?

DR. HINZE: Well, you need a softball question, and I'll ask one that demands only a single word answer.

One of the topics covered in the white paper is the siting of fuel cycle facilities. My question is, is there any need for regulation, modifications taking into account siting considering a disruptive events?

And do we have any experience - that's the second question - and do we have any evidence from the international arena on this topic?

VICE CHAIR CROFF: Such a softball nobody is going to answer it.

MR. DIAS: I am actually struggling with the question.

MS. SNYDER: I am too. Can you repeat the question, please?

DR. HINZE: I'll ask it very simply. Is there a need to consider modifications to current regulations of the NRC in terms of the siting of fuel reprocessing or recycling facilities, taking into account the possibility of disruptive natural events? Seismic activity, landslides, tsunamis, volcanoes, et cetera. Is there any -

MR. GIITTER: We talked about this yesterday a little bit.

This is Joe Giitter, NMSS, fuel cycle division.

There is actually, if you look at Part 50, Part 50 is a regulation that we currently apply to reprocessing facilities. And about the only thing in Part 50 that even talks about reprocessing facilities is I think Appendix F. Is that right? It's one of the appendices of Part 50, and it has to do with siting reprocessing facilities.

We do -

MS. SNYDER: It's not detailed.

DR. HINZE: And that's my point.

MR. GIITTER: Any type of facility that we regulate under Part 70, and I'm using that as an example, not to say that we would necessarily license a reprocessing facility under Part 70, but we are looking at that as a possibility. You have to go through a formal process. You use Part 51. As I said yesterday you look at the effect of a plant on the environment. You look at the effect of the environment on the planet. You look for safety hazards. You look at external phenomena, earthquake, tsunami if it was on the coast or something; anything that would apply in looking at the risk of that facility.

And under Part 70 we have specific requirements in the integrated safety analysis that would require you to look at external hazards for example in coming up with accident sequences.

So we do have a process in place. It's a process that we have used in licensing the gas centrifuge facilities, in issuing the construction authorization for the MOX facility.

We would apply the same process or

something very similar to that, I would envision, for reprocessing facilities.

DR. HINZE: that's a maybe, no or yes?

MR. GIITTER: I'm not sure -

DR. HINZE: If you can answer that in one -

MR. GIITTER: I would say maybe, and I think that covers everything.

(Laughter)

MS. SNYDER: I'll second that, because we need to evaluate it.

VICE CHAIR CROFF: Larry, you got a question?

MR. TAVALRIDES: No.

VICE CHAIR CROFF: Ray?

MR. WYMER: I wanted a point of clarification. It was suggested that we have read a lot about the ULEX process; we know a lot about it. But there is not much discussion of the other processes, which would be CCD/PEG, TRUEX and TALSPEAK. The reason we haven't heard so much about those is because we don't know much about those, certainly not on the kind of a scale that we know about the ULEX. There's been a fair amount of experience with TRUEX, but with TALSPEAK at any kind of a scale at all it's virtually nonexistent. So it's hard to say much about a process that not much is known about.

So I'd like a little bit of clarification of what sort of things might you be looking for.

MR. REED: Okay, I was looking basically for the type of reactions. TALSPEAK separates the lanthanites from your transuranics; leaves your transuranics behind. There are processes and chemicals involved. There are thermodynamic issues involved. There are decontamination factors. You know what exactly - are we at the right pH and things like that.

In other words a lot of the details that we would need if for example we did an accident analysis, so criticality. We would need to know - now we have not seen much - any DFS whatsoever. We don't know what the fraction of separation is as opposed to pH for example. A lot of those chemicals, for example, the organic chemical that you'd use is, we don't know what the radioloysis effects, you know.

MR. WYMER: It's a good point, because TALSPEAK is very sensitive to pH.

MR. REED: Right.

So those are the kinds of things I think as a regulatory group we would want to know, if we followed the process through in any type of a regulatory type analysis.

MR. WYMER: We can add that type of thing. I thought maybe you were looking more on the operational side.

But certainly on the basic chemistry side, yes, there's stuff we can add.

MR. TAVOLRIDES: Yes, it's that same point, to what level of depth do you wish this to go, and to do it in a month and a half I think is a constraint to make it somewhat challenging.

VICE CHAIR CROFF: We can probably do some of it to give some understanding and incorporate the rest by reference.

MR. WYMER: I think we can do about what he was suggesting there.

MR. TAVOLRIDES: One more comment if I may.

MR. DIAS: Can I have a comment on that.

I understand the desire to understand the technical information, and we'd be more than happy, but not in a public forum, to share that information for our processes if that helps, but we would not do that in public. We would need to have proprietary protection.

But equally I think that the focus in

regulation has surely not got to be on how you achieve the goal but can you achieve the goal. And at the moment the issue is what change in regulation is required, is it not?

Am I making that clear? Do we need to change the regulation? And are we satisfied that when we change the regulation we could license these facilities with those changes? The licensee has got to make the case that the requirements are being met. And I'm puzzled as to what that -

MS. SNYDER: And we have to make sure that the requirements are doable. I mean we can't require a license applicant to provide something that they cannot provide.

MR. DIAS: My ignorance of the regulations is letting me down.

MR. NORATO: Your point about the proprietary nature of some of the processes is well taken. However, in a case of something like TALSPEAK, some of that information is just not available yet.

But from a general point of view it would be helpful for the staff to understand, compare your process for example to something we do understand very well, such as PUREX. So that when we look at compliance with regulations in terms of safety and safeguards, we understand how it's similar and how it's different. So it kind of is a comfort factor for understanding, going with something we don't know as well based on something we do understand quite well.

MR. WYMER: We do have information, and we can add it, on things like the effect of pH, and the effect of aqueous to organic flow ratios which are key parameters on the TALSPEAK process that are known and are available and that you would have to make a value judgment at the NRC whether or not these could be controlled adequately. We can provide that kind of information and will.

MS. SNYDER: That would be helpful.

VICE CHAIR CROFF: Okay, John, you've been trying to get in here.

MR. FLACK: Just to follow up on all this, and I think to try to put it in perspective, when you look at the regulatory process, you want to look at what's generic about it. What is that we are trying to achieve with the process? And then apply it to a specific technology.

I think at this point - I mean a lot could be done in that the paper can continue to grow with a lot of specifics. There is no end in sight, basically, because all these - you will get down to a certain level of technology where you start to say, well, what does that mean?

But I think just at the highest level, how does the regulations need to change to accommodate reprocessing? That in itself requires some thought.

Before we get you up to again to what's the next level down, but what techniques are we talking about. And I'm going to go back to advanced reactors. If it becomes so complicated that the regulations - it takes a major change to the regulations to do what you want to do, to accommodate a specific technology, then it's like a rule for that technology. And we see that happening to Part 50 right now, when you have a sodium plant or a gas cooled reactor, you start to question whether or not you want to use Part 50, or do you want to develop a specific regulation targeted for that technology.

But right now the technology, it's still evolving. And I think going into that kind of detail, it really spreads the paper out. I mean it becomes like a pyramid trying to capture everything.

So I think going back and saying, okay we have to be sensitive to the things and the variations in the technology, and what that might mean in a regulatory process. But we still need to look in a broad sense at what the regulatory process needs to do and how it needs to change to accommodate at some generic level reprocessing. I think that is going to be the big challenge.

And then again you'll have to do the same thing for sodium cooled reactors. Are we going to use quad 50 for that, and that's where you end up with this Part 5x.

I don't know, because like you said, the time is limited

MR. WYMER: I could provide what they are talking about doing in a couple of hours. That's information.

MR. TAVOLRIDES: The last thing I wanted to say was more of a clarification on, expand international experience.

So I see where that raises some possible information we would like to get, but we can't because of its proprietary nature.

So what do we mean by, expand the international experience, in the paper? Are we talking about the accidents? Are we talking about the releases of gases in liquid radioactive materials or what?

MR. WYMER: It's hard for you to say. I

was going to ask you to do that.

(Laughter)

DR. HINZE: I think the answer is yes.

VICE CHAIR CROFF: You get what's there in the time available is about the answer.

Let's go down around the table. Dan?

MR. STOUT: Nothing else.

VICE CHAIR CROFF: Okay.

MR. HANSON: What John was just saying here is particularly interesting. I think in terms of the focus of the NRC and the regulations, you got to drop back to the purpose.

And the fundamental purpose is to protect the public health and safety. And you can write regulations that will do that that are pretty simple. You don't have to know the precise pH or even all the chemicals that are used in the plant in order to do that.

You need to prevent criticality. You need to prevent fires. You need to limit your releases, and you need to limit off site doses.

And you can write regulations to do all of those things. And if you have done that you have pretty much done your job without knowing all the precise chemistry associated with doing some of these sophisticated preparation processes.

CHAIR RYAN: I'll stick up for the staff. I think that is a little simplistic. I mean they really need to understand the processes to know what they're running will cover. And they need to understand almost as much as -

MR. HANSON: But we don't know what the processes are today that are going to be used.

(Simultaneous voices)

CHAIR RYAN: I don't think the staff can just write something at that global level and say, here, follow these rules and we'll be okay. I just don't see that happening.

MS. DAVISON: But this kind of paper that you are talking, is this the one that is going to provide those guidelines? Or is this supposed to be kind of that overview to get started?

I guess that's why I'm a little confused. Because I can see, I agree with you, if it is to actually provide the guideline of how you are going to actually evaluate in the future. But as Dan said, you don't know -

(Simultaneous voices)

CHAIR RYAN: Remember what the purpose of this paper is. This is an ACMW white paper to help us get educated, and to provide a knowledge of management product to the commission with some recommendations in a letter.

The staff has given us input, but it's all work product. We are not writing this for what the staff is going to do. Their work is going to commence with that.

MS. DAVISON: I understand. So I guess my question would be on this, then do you need from industry some additional information about what exists right now, the starting place now. As Alan said there is a limit when you start talking about alternative processes besides PUREX out there.

Is there a way we can help on some of this, and fill in some of the information or providing -

MS. SNYDER: Helping the staff?

MS. DAVISON: That's what I'm asking.

MS. SNYDER: That's what we need to know, are you asking about helping ACWM, or helping the staff in the staff's -

MS. DAVISON: I was actually addressing it - is there a way that industry can help you as far as providing - we can provide comments on some of the sections, or help give you more information that you can rewrite part.

I don't know how we can help, or how you want us or if you want us to help.

VICE CHAIR CROFF: We certainly want you to help. You know there is the modern operating - well, processes, equipment, and approaches and control reside in really just a couple of facilities with really substantial operating experience. And it's really useful to know how well it's operated. Where have there been problems?

Have there been accidents? And what caused them? This kind of information is very valuable. It sort of tells us what we need to watch as a committee, and it helps the staff to know what they have to think about in terms of developing a regulation.

So we definitely want the benefits of that experience to the extent you can release it. Obviously8 proprietary information isn't going to do us much good at this point.

But I would suspect a lot of this in terms of releases and this kind of stuff that goes outside of the plant is necessarily public information.

You know you have to file annual reports, or your regulators in other countries require something; I don't know what. And it would be helpful to point us at that, as well as what you can tell us about how the plan is designed, what kind of processes and approaches you use inside the plant.

And I know you can only go so far there. I mean that's understood, and we are going to have to live with that at this point and at this level.

But we the committee are trying to get smart enough so we can advise the commission on the directions we think staff should be taking or not taking. And much of the time we agree with staff; sometimes we don't agree with the direction we are taking. But that is why we are an independent body.

So in many cases we end up requiring a lot of the same information that staff does up to a point.

CHAIR RYAN: I think our colleagues from Energy Solutions touched on - Dorothy you touched a little bit on in your presentation to us previously, and that is the environmental side of this. What are the release profiles?

You know the airborne and water borne release rates for key radionuclides is a function of metric tons processed, which would be an interesting kind of thing to give insights to the staff and the commission.

MS. DAVISON: Well, in another area that was mentioned earlier, you had mentioned about - I mean this is really an impressive document. It's always easier to read a document and edit than it is to ever start on something this detailed. So there is a lot of good information in here.

But again, starting from a plant that is 30 years old that never operated, there are a lot of things that have changed from a safety - that are going to have a really significant impact if you start with what's there today.

I mean chemicals - there are a lot of changes that are out there that are used now that didn't exist 30 years ago. And so I guess I'm still not clear how you - I mean I can write comments. There are sections of - if you want us to actually - and I'm offering -

VICE CHAIR CROFF: If you are asking about the form, we welcome either written comments or documents.

MS. DAVISON: Okay.

VICE CHAIR CROFF: Either one, or websites that we have missed, whatever it is.

MS. DAVISON: Again, we're just saying, we're willing to help however we can. Because I think this is a really important document.

But again we also don't want people to have the impression that where the technology is is where it was 30 years ago, because the world is totally different than 30 years ago on reprocessing, and that is a big concern. Because when you look at some of those numbers, and the doses and all to the population, the concern is, I think it's going to have a negative impact.

VICE CHAIR CROFF: Is there updated or additional data on any of those topics?

(Simultaneous voices)

MR. DIAS: We will be more than happy to do the same. And I just wanted to clarify, the proprietary information, we are willing to share that under certain circumstances.

I appreciate the public restrictions, but the things that Alan just went through, the lessons learned and all the rest of it, no problem. Let's just find the best way to get the information to you guys quickly.

CHAIR RYAN: That's certainly you may deal with the staff at some future point. But we are a committee that operates in public. We don't collect information that is not public.

MR. DIAS: There is still - I'm just talking about, it's absolutely for the public. You know, the lessons learned or the things that Alan mentioned, he didn't talk about proprietary flow sheets. He talked about good stuff that we can benefit from learning. The question is how can we get that quickly to the staff and to yourselves.

(Simultaneous voices)

MR. DIAS: We'll make sure we get that to John.

MR. GIITTER: This is Joe Giitter again. I just wanted to add something.

My first opportunity to read the white paper was on an airplane to Vienna, and I participated in a working group on developing a draft safety guide on reprocessing facilities. And I'll tell you, I learned a lot, because we had people from Areva, from Russia, from DNFL, that were on this committee, people who had experience in commissioning both MagNOX and oxide reprocessing facilities.

And I can tell you that after having just read the white paper, and then having spent a week at IAEA, my general impression was, is consistent with what I've heard here.

It is outdated in the sense that it looks at U.S. experience only. And the world has changed in 30 years, and there are a lot of things that we can learn from our counterparts in the UK and in France.

And one of the things that we have been thinking about and talking about within our staff is possibly going to NII to get some information on their regulation of the reprocessing facilities.

CHAIR RYAN: That's very helpful, thanks.

VICE CHAIR CROFF: I think we've just about been all the way around, and we are starting to run a little bit over.

I wanted to get a couple of points out that I think may be important. One for Dan. I'm told that the department is working on what I will call a GNEP waste management strategy. That may be close to its name, a work in progress as I understand it.

Can you say a little bit about what it is, and when we might see a draft or a version of it?

MR. STOUT: Well, Amy sent me a note and said where is this paper. I'm not sure. I know that there is a waste campaign manager responsible to deliver an integrated waste management strategy. And he's on the hook to deliver it this year.

So I started looking for something that was in the May-June timeframe and came up empty.

But I am familiar with work to create an integrated waste management strategy. It is going to look beyond just high level waste. It's going to be looking at the overall waste, high level, low level, greater than class C, et cetera, from GNEP deployment.

VICE CHAIR CROFF: Okay.

MR. STOUT: So at the time that would be completed, we would be able to make that available.

MR. BOARDMAN: Again, would it be based on a ULEX baseline?

MR. STOUT: I don't know the answer to that.

MR. WYMER: Allen, you might want to give these people who have generously offered to update us some indication of what the schedule is we're on.

VICE CHAIR CROFF: I'll do that. I've still got one more thing I'd like to hear from them.

And that is, in going through the issues the issue of research was mentioned. And I'd be interested in any cogent thoughts on what you see as the more immediate research issues, either what NRCX research folks should be looking at, or what you think the most important ones that - well, let me call it DOE or industry should be looking at, the actual developers of the processes.

What sticks out as really the big two or three things that need to be resolved to go to a ULEX type of COEX or whatever kind of a facility.

MS. DAVISON: I would put effluents first.

VICE CHAIR CROFF: Control processes?

MS. DAVISON: I would put effluents in, and the regulations to go with them. And then I think waste - I think I would put waste as a secondary issue on that.

VICE CHAIR CROFF: Okay, all right.

Well, with that, I guess, pursuant to Ray's suggestion, our path forward is, we have been working on the NRC staff comments during the last few weeks after the external review went out.

We look forward to receiving your comments by the end of the month. Our plan is to spend August and on into September revising the report to reflect all of what is sent in, and that, depending on what we get, that may be overly heroic or not. We'll just see what we get.

And in parallel with that, I'll be working to draft up a letter for consideration by the committee based on the white paper, and a lot of the other stuff we've heard that is not strictly in the white paper. Such as we've heard briefing from Areva and Energy Solutions, and we have had briefings on into last year from DOE and Im Ladler and those kind of people.

So all of that is going into the hopper into what is going to be in the paper, and in our thoughts in the letter. My hope is to have the draft letter on the table in September and get it out then. So that is the goal at this point.

And it will depend largely on the number of comments we get, and how difficult some of them are. So that's where we're going.

CHAIR RYAN: Just for everybody's calendar, that is the week of the 17^{th}. So the week of the 17^{th} of September.

VICE CHAIR CROFF: Okay, and with that, if there is nothing else, I'd like to thank you all very much for attending the roundtable; for your insights, and the dialogue back and forth is very helpful in steering us, and I hope it's been at least a little bit helpful to you to sort of understand where we're going and what is going to happen.

CHAIR RYAN: Let me add on behalf of the entire committee thanks to everybody that has participated. We really appreciate the staff's comments, our colleagues from industry, our consultants have done a great job of getting us this far. And we really appreciate the positive feedback and suggestions as to how we can make the report better.

VICE CHAIR CROFF: Is there anybody in the audience that wanted to say anything?

MR. KRAFT: While hesitating to delay the procedures here, Steve Kraft, NEI.

CHAIR RYAN: You may have as much time as you want.

MR. KRAFT: I'm completely confused, but you guys sort this out. I mean I'm confused. I don't know who is working for whom here, or who is going to inform what, but I'm sure you will sort it out. You are all great people.

How come no one mentioned the MOU between DOE and NRC that got executed yesterday on exactly this topic?

CHAIR RYAN: Yesterday? We have to be up to date with yesterday? I haven't seen it.

MR. STOUT: I didn't recall it being mentioned either today or yesterday morning. DOE and NRC entered into a memorandum of understanding that provides the ability for the staff to continue to get educated on GNEP. And there is more work to be done.

We have to execute an interagency agreement and scope of work and that kind of thing.

But it's an important step towards being able to help inform the staff on GNEP.

(Simultaneous voices)

MS. SNYDER: I'll leave this with John.

CHAIR RYAN: Yes, please.

Okay, anybody else? We are adjourned. Thank you very much.

(Whereupon at 5:08 p.m. the proceeding in the above-entitled matter was adjourned)