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Facilities

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 PUBLIC MEETING

5 + + + + +

6 WORKSHOP ON DEVELOPMENT OF REGULATIONS FOR SPENT
7 NUCLEAR FUEL REPROCESSING FACILITIES

8 + + + + +

9 WEDNESDAY

10 SEPTEMBER 8, 2010

11 + + + + +

12 The meeting convened, at the Hilton
13 Washington D.C./Rockville Executive Meeting Center,
14 1750 Rockville Pike, Rockville, MD, at 8:30 a.m.,
15 Francis Cameron, presiding.

16 PRESENT:

17 FRANCIS CAMERON, Facilitator

18 SVEN BADER, AREVA

19 MARISSA BAILEY, NRC

20 JIM BRESEE, DOE

21 JOSE CUADRADO, NRC

22 YAWAR FARAZ, NRC

23 JOHN FLACK, ACRS

24 THOMAS HILTZ, NRC

25 MIRIAM JUCKETT, CNWRA

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PRESENT: (CONT.)

MARSHALL KOHEN, NRC

MIKE LEE, NRC

ERIC LOEWEN, General Electric

ED LYMAN, Union of Concerned Scientists

ARJUN MAKHIJANI, IEER

ROD McCULLUM, NEI

ALEX MURRAY, NRC

PHIL REED, NRC

STEVE SCHILTHELM, Babcock & Wilcox

DANIEL PAUL STOUT, TVA

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C-O-N-T-E-N-T-S (CONTINUED)

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for Next Workshop

Chip Cameron

Workshop Facilitator

Adjourn

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

8:45 a.m.

1
2
3 MR. CAMERON: Okay, we're going to get
4 started.

5 If you need coffee, make sure you get it
6 now because it will disappear at nine o'clock, and
7 there's tea out there also.

8 But good morning and welcome back for our
9 second day of discussions. I thought yesterday was
10 pretty fruitful and thoughtful, good discussions on
11 two difficult topics and, also, a good learning
12 experience for all of us who are involved in planning
13 the workshops because I think we learned something
14 about how to perhaps better tee-up the issues on the
15 risk/safety segment for the Albuquerque workshop.

16 The Albuquerque workshop is going to be
17 two full days instead of a day and a half, and it is
18 scheduled for October 19th and 20th. We will be
19 sending out notices to everybody about where that is
20 going to be.

21 Jose, were we going to do another Federal
22 Register notice on it? Public notice?

23 MR. CUADRADO: We had the date for the
24 October workshop as the week of the 4th. So it would
25 probably be appropriate to issue another one and

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1 revise the dates.

2 MR. CAMERON: Okay. So there will be a
3 notice. Because as typical with the meetings that we
4 have in Washington, D.C., we get a lot of people who
5 are professionally-interested in the subject, not a
6 whole lot or perhaps any members of the, quote,
7 "public". But usually, when we go out in the regions,
8 there will be public interest in it.

9 I don't want to make any jokes about one
10 of the companies here planning to cite a reprocessing
11 facility in Albuquerque so that we can pack the halls
12 or anything, but I think we will have more people from
13 the public interested in this.

14 We are going to start with the design and
15 operational aspects. Alex is going to tee that up for
16 us.

17 As you already gathered, this doesn't run
18 like a train, or maybe it does run like a train. We
19 will be a little bit off-schedule perhaps, but we do
20 need to start the security and safeguards discussion
21 at 2:30 sharp because the NRC person, Marshall Kohen,
22 who is going to tee that up for us, has to leave at
23 3:30. So we want to have him here for that full
24 discussion.

25 We have Eric Loewen from General Electric

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1 with us. And I'm going to just ask him to introduce
2 himself.

3 MR. LOEWEN: Good morning. My name is
4 Eric Loewen. I work for GE Hitachi Nuclear Energy
5 down in Wilmington, North Carolina. I apologize for
6 not being here yesterday.

7 What we are trying to do is commercialize
8 the technology with, hopefully, a consortium of
9 companies that was developed in our National
10 Laboratories. Some of you might know it as the
11 Integral Fast Reactor Program or the Advanced Liquid-
12 Metal Reactor Program. So that is a technology that
13 we call recycling, where you are actually using a fast
14 reactor to get rid of all the transuranics.

15 So that is where we are coming from. We
16 have been public about that with our grant that we got
17 from the Global Nuclear Energy Partnership, and last
18 week we talked about that in front of the Blue Ribbon
19 Commission Subcommittee on Fuel Cycles and Reactor --
20 one of the subcommittees. It was chaired by Per
21 Peterson and Senator Domenici.

22 So I am pleased to be here and want to
23 learn. Thanks.

24 MR. CAMERON: And thank you for joining
25 us.

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1 Everybody did pretty well with this. If
2 you want to talk, and I'm just doing this for your
3 benefit, Eric, if you want to say something, we have
4 been using the turn your name tent up on that.

5 Okay. Anybody have any questions,
6 observations before we get started?

7 (No response.)

8 Mr. Murray?

9 MR. MURRAY: Thank you, Mr. Cameron.

10 Good morning, everybody. We would like to
11 resume our discussions this morning. The area which
12 we'll start off with, we sort of used these terms
13 design and operational requirements. It basically is
14 a catchall for several areas which come up in many of
15 the regulations which either are or appear to be
16 potentially applicable to reprocessing and recycling.

17 Next slide, please.

18 In NRC regulatory space, there generally
19 are three areas. I have listed them here. Generally,
20 there are some requirements and regulations which are
21 somewhat prescriptive. There also are some
22 regulations which usually have a risk or some sort of
23 risk-informing involved. Sometimes there are some
24 performance requirements identified. We discussed
25 those yesterday afternoon.

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1 And then, there are some other parts of
2 the regulations which discuss minimum criteria or
3 minimum requirements, and that was sort of touched on
4 a little bit yesterday as well. And we are going to
5 discuss those this morning.

6 Some of these minimum criteria include
7 things like design criteria. These are sometimes
8 called GDCs, General Design Criteria, in many parts of
9 the NRC regulations. Part 50 has Appendix A on
10 General Design Criteria. Part 72 has a whole section
11 on General Design Criteria, et cetera.

12 In one part of the regulations, Part 70,
13 they are called Baseline Design Criteria. Basically,
14 the terms are used synonymously, but there can be some
15 slight differences in how they are applied.

16 Another area of minimum criteria involve
17 technical specifications. We are going to discuss
18 those a little bit as well. And another area we will
19 discuss has to do with the personnel or operators of
20 potential future reprocessing and recycling
21 facilities.

22 The key thing about minimum criteria or
23 minimum requirements is that these add to the defense-
24 in-depth: redundancy, diversity, independence, and,
25 in essence, enhanced safety.

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1 The next slide, please.

2 On this slide, I have just given a brief
3 explanation about General Design Criteria, Baseline
4 Design Criteria. Again, these are a minimum set of
5 requirements that the NRC requires licensees or
6 applicants to address. I have listed some of the
7 attributes here.

8 The next slide, please.

9 Okay. We are discussing recycling,
10 reprocessing/recycling facilities. Reprocessing
11 facilities are production facilities, and they are
12 currently regulated under 10 CFR Part 50.

13 Now Part 50 has General Design Criteria.
14 These are referenced in a part of the regulation,
15 50.34. Appendix A lists them for nuclear power
16 reactors.

17 Even though Part 50 applies to
18 reprocessing facilities, it does not have any specific
19 General Design Criteria for them. We will discuss
20 that in a moment a little more.

21 There are some other parts of Part 50
22 which imply other potential General Design Criteria.
23 There's an Appendix F which discusses waste; Appendix
24 I, ALARA, on emissions and effluents; S is on seismic,
25 et cetera.

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1 And the staff has looked at this, and we
2 have concluded that some General Design Criteria,
3 Baseline Design Criteria, that are specific to
4 reprocessing/recycling facilities may be needed.

5 Next slide, please.

6 Now when we started this work a year or so
7 ago looking at potential General Design Criteria for
8 reprocessing and recycling, we were perplexed because
9 in the existing regulations there is actually a
10 footnote to 50.34 that says General Design Criteria
11 for chemical separations facilities are currently
12 being developed. And we said, well, hold on, where's
13 this going on?

14 And apparently, that is an artifact from
15 the late seventies and early 1980s, when they were --
16 they, us, the NRC -- were developing some General
17 Design Criteria. And I have listed on this slide
18 those previously proposed Appendix B, Appendix P,
19 excuse me, which listed 27 General Design Criteria in
20 seven categories.

21 If I could have the next slide, please?

22 There was also a previously proposed
23 Appendix Q, which dealt more with General Design
24 Criteria that might be applicable to material control
25 and accounting and physical protection. And again,

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1 this had several, I guess it's 19, General Design
2 Criteria in three categories.

3 Next slide, please.

4 Now we, the staff, have looked at this.
5 We noticed the proposed regulations, the existing
6 regulations right now do not have any thresholds for
7 applying any of the General Design Criteria.

8 We also went through and thought, okay,
9 from the list of General Design Criteria that are out
10 there, be they in the existing Part 50, the two
11 proposed appendices, Part 70, Part 72, we looked at
12 those and said, well, there may be upwards of 10
13 potential categories and upwards of 70 or so potential
14 General Design Criteria that could apply.

15 Next slide, please.

16 Here I have just given some of the
17 potential categories that the staff has come up with.
18 Some of these were discussed at the May public
19 meeting.

20 Next slide, please.

21 Now let me move to another area of minimum
22 criteria, minimum requirements, technical
23 specifications. Technical specifications, a little
24 hard to describe. They are sort of like, when you see
25 them, you know what they are; you know what they mean.

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1 Because reprocessing facilities are
2 production facilities, technical specifications are
3 required by the Atomic Energy Act. They are actually
4 referenced currently in Part 50.36.

5 Part 50 has a very extensive discussion
6 about technical specifications. There are guidance
7 documents related to Part 50 which discuss technical
8 specifications in lugubrious detail.

9 In the early 1970s, there even was a
10 Federal Register notice which discussed proposed or
11 potential technical specification categories for fuel
12 reprocessing plants. Part 70 facilities are not
13 required to have any technical specifications.

14 The gaseous diffusion plants, which are
15 regulated under Part 76, another part of the NRC
16 regulations, they have technical safety requirements,
17 which are somewhat like, have some similarities to
18 technical specifications.

19 Next slide, please.

20 On this slide, I have just listed some of
21 the considerations which go into technical
22 specifications. In general, technical specifications
23 come from safety analyses about the proposed facility
24 or facilities, both the design and operations. I have
25 listed some of the categories: safety limits,

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1 limiting conditions for operations, et cetera.

2 A key thing is technical specifications
3 can include both what we call technical or engineered
4 attributes, not to exceed a certain temperature, not
5 to exceed a certain pressure, what those might be, how
6 many hours or days the system can run, a part of the
7 facility can run with a certain subset of equipment
8 functioning or with a limited functionality, et
9 cetera.

10 It can also include the administrative
11 side. Okay. It has the time between calibration of
12 instruments and equipment, for example.

13 Next slide, please.

14 And just another last area which we will
15 just mention regarding minimum requirements, this has
16 to do with the training of operators at reprocessing
17 and recycling facilities.

18 The Atomic Energy Act does require the NRC
19 to establish criteria for operators of production
20 facilities. Again, reprocessing facilities are
21 production facilities.

22 The Atomic Energy Act requires the NRC to
23 determine what the qualifications of some of the
24 operators, some of the criteria for training them, and
25 so forth, and then to issue licenses.

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1 These are currently codified in another
2 part of the NRC regulations. It is called Part 55.

3 Right now, those regulations are heavily
4 focused towards nuclear power reactors. And again,
5 the appropriate level, requirements for operators at
6 reprocessing and recycling facilities will need to be
7 determined, either as part of an amended Part 55 or
8 perhaps as a part of a new reprocessing and recycling
9 regulation.

10 And next slide, please.

11 Here, I have just listed some potential
12 points of discussion to kick it off, and here's Chip.

13 MR. CAMERON: Okay. Thank you, Alex.

14 Alex just walked through the traditional
15 hierarchy of design and operational requirements for
16 NRC facilities. The staff focus is how to develop
17 this for reprocessing facilities. So they are looking
18 to all of you to give them some suggestions on that.

19 I don't know if anybody would like to
20 start us off on these questions. Alex, in terms of
21 moving through these, does it make sense to start with
22 the first bullet or is there a more appropriate,
23 larger issue to take on, from your point of view?

24 MR. MURRAY: Several times during the
25 discussion yesterday, there were a number of

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1 statements about some minimum requirements, regardless
2 of what a safety analysis, be it PRA, ISA, or other
3 risk-informing methodology, might do, might be needed.

4 Okay?

5 One was, well, yes, even though the
6 potential, the probability, or likelihood of a
7 sequence could be reduced, there still should be some
8 requirement to mitigate the consequence. That was
9 mentioned a couple of times, some sort of base level
10 of, for want of a better term, safety equipment,
11 safety controls. That was mentioned a couple of
12 times.

13 So, you know, I guess my first thing I
14 would throw out there, okay, is there something, are
15 there some things which are universal, you know, yes,
16 ALARA applies, but something beyond that? I don't
17 know, some criteria. I put up there spent nuclear
18 fuel burnup from the overseas facilities does seem to
19 have some, if you will, safety relevance, some top-
20 level applicability.

21 MR. CAMERON: And these standard criteria
22 would be memorialized in a BDC and/or tech specs or?

23 MR. MURRAY: It could be either. It could
24 be some breakdown or both, yes.

25 MR. CAMERON: Okay. John?

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1 DR. FLACK: Yes, you know, going back to
2 how we work with reactors, we usually try to -- well,
3 we start off with design basis accidents. And from
4 there, those are the accidents you want to be prepared
5 to deal with as part of the design. Okay. From
6 there, everything begins to evolve as to what safety-
7 related equipment you might have, and so on.

8 So my thinking here is there is a similar
9 set of accidents that one can think about for these
10 facilities where you would start from and say, again,
11 deterministically, where that becomes your core. And
12 then, from there, you build around that, and there
13 could be other things.

14 Now, with reactors, of course, you don't
15 say that's the end in and of itself. You go to the
16 PRA to see whether the accidents might be important
17 for the facility, and so on. But at least you start
18 off somewhere. Whether it is a double-ended
19 guillotine for a reactor, loss of offsite power,
20 there's a certain set of accidents for those types of
21 facilities. Is there a similar kind of set of
22 accidents for these facilities or we just don't know
23 what they are right now? Maybe that is the starting
24 point.

25 So it kind of pushes everything up a

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1 notch, starting something at that level, and then from
2 there, going down to the kinds of levels you're
3 talking about. Okay, then how much defense-in-depth
4 do we need, and so on and so on?

5 I don't know; just throwing it out there.

6 MR. CAMERON: And thanks, John.

7 I would note that Ed Lyman, one of the
8 points he made yesterday is establishing some design
9 basis accidents deterministically. John is saying
10 you've got to start this whole exercise with looking
11 at design basis accidents and then build around that.

12 Rod?

13 MR McCULLUM: Yes, I would agree with John
14 that that's probably a good place to start. I would
15 caution, again, in the spirit of risk-informed,
16 performance-based, trying to say that there is a
17 cookie-cutter list of accidents that would apply to
18 any recycling facility.

19 I think a risk-informed, performance-based
20 regulation could specify requirements for identifying
21 the design basis accidents. It could specify the
22 level of rigor with which you would want to identify
23 those design basis accidents and the types of things
24 that you would need to show to mitigate them.

25 One thing I would point to, and I know

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1 there's some people from NRC around the table here who
2 are familiar with this, I think one of the best
3 examples of risk-informed, performance-based
4 regulation we have in that regard is 10 CFR Part 63.
5 I apologize for bringing up Yucca Mountain, but it's
6 something that I know.

7 It talks about the types of information
8 that DOE has to collect about the geology, but it
9 doesn't say things as specific as, you know, okay, the
10 colloids are going to have to travel at this rate, and
11 so on and so forth.

12 So I think you could specify in that
13 spirit a set of requirements that give confidence that
14 you will be getting an application that appropriately
15 defines the accidents, analyzes them, and demonstrates
16 they can be mitigated without having to specify here
17 are the 13 accidents you have to worry about in a
18 reprocessing facility.

19 MR. CAMERON: Okay. Thanks, Rod.

20 Steve?

21 MR. SCHILTHELM: Yes, and just kind of
22 building on those two points, nearly all the
23 regulations -- and Alex laid it out -- have some form
24 of design criteria, Baseline Design Criteria or
25 General Design Criteria, or whatever they are called

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1 it in Part 72.

2 We offered, when we put the White Paper
3 together, that there be some set of design criteria.
4 Those design criteria, in a sense, they help guide you
5 to identifying what those design basis accidents might
6 be.

7 An example in Part 70, don't have
8 inadvertent criticality accidents or prevent
9 inadvertent criticality accidents. Well, they help
10 guide you to a point of, okay, I need to consider an
11 inadvertent criticality.

12 So I think, in general, regardless of what
13 the list looks like, people seem to be in line with
14 the need for a set of Baseline or General Design
15 Criteria for these facilities.

16 MR. CAMERON: Okay, and I guess a question
17 is, where do you start? What comes first on this?

18 Arjun? And then we will go to Ed.

19 DR. MAKHIJANI: Well, I think you have to
20 have both design criteria as well as specified
21 accidents because we are revisiting the technology-
22 neutral discussion by other means by saying, one, that
23 we are just going to have performance-based, and so
24 on, and you specify the criteria, and you don't have
25 to have a list. Well, you do have to have a list.

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1 I brought up yesterday the question of
2 tank explosions, which the gentleman from Oak Ridge
3 said was not relevant. But I didn't have a chance to
4 point out that the Norwegian Radiation Protection
5 Authority in 2009 thought it was relevant for PUREX
6 plants and did a study of a release from the British
7 reprocessing plant, and concluded that it could result
8 in cesium contamination of Norway, between 10 percent
9 and 5,000 percent of the contamination that resulted
10 from the Chernobyl accident, which is clearly
11 unacceptable to them. This is the Norwegian Radiation
12 Protection Authority.

13 Now they didn't specify the mechanisms of
14 the accident, but we can think about what they might
15 be. It is not that hard.

16 So I think a design criterion might be,
17 you know, that would relate to all aqueous plants, we
18 are going to have liquid high-level waste storage.
19 You've got to limit the worst-case release. Ten
20 percent of Chernobyl is just unacceptable. In my
21 opinion, it is unacceptable, but the NRC and the
22 public have to decide what is unacceptable.

23 Then, the design criteria for the plant
24 itself, that would be technical, and the defense-in-
25 depth, and so on, come second. But, clearly, it

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1 relates to technologies with aqueous waste and would
2 not be the same for technologies that don't have
3 aqueous waste.

4 So, even when you have General Design
5 Criteria, a lot of them are going to be technology-
6 specific, at least in the broad sense, and not just
7 general that, you know, we're in reprocessing and this
8 applies to all reprocessing. There will be some like
9 that, but not all.

10 MR. CAMERON: And is what Arjun just
11 described, is that consistent with other people's
12 thinking on this, that there will be some that are
13 going to apply to any technology, and then you would
14 have specifics for a certain type of technology? Or,
15 Rod, are you saying that, you know, going back to the
16 risk-informed, performance-based, that that could sort
17 of cover the waterfront for anything?

18 MR McCULLUM: I don't think that what
19 Arjun said, and I am going to continue to try to build
20 common ground because we had some very notable
21 instances of that yesterday, is necessarily
22 inconsistent with what I said or with what Steve said.

23 I think it really depends on a couple of
24 things. First of all, the level of prescriptiveness
25 or specificity with which you describe the accident.

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1 I mean you can talk about requirements to prevent
2 criticality, and you can talk about the level of rigor
3 with which the applicant will need to demonstrate that
4 they can prevent criticality. And you could actually
5 get into a fairly detailed regulation, but you don't
6 have to go to the point of talking specifically about
7 parameters you need for aqueous systems or parameters
8 you unique to metallic systems.

9 I think there is a level of detail there
10 where you can appropriately do that, that you can meet
11 Arjun's request to identify accidents, but to do it in
12 a risk-informed and performance-based manner. I'm
13 sorry I keep saying that, but that's my mantra.

14 And I think the second way is when you get
15 to something that is so unique about a different type
16 of facility, you can bifurcate the regulation. You
17 can have a Section 7x.y that addresses aqueous and
18 7x.z that addresses pyro processing. And if one of
19 those technologies is not advanced enough when you're
20 writing this initial regulation that we encourage you
21 to stay on your current schedule for, you can leave a
22 placeholder.

23 In fact, Alex brought up a couple of
24 excellent examples of things. There was a footnote to
25 an appendix that, well, we walked away from

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1 reprocessing back then, so it didn't get written.

2 But you can do the same thing today. And
3 that proved out to be very good because we are,
4 indeed, coming back to those placeholders. So I think
5 where you can't be completely risk-informed,
6 performance-based, or you don't feel you can, you can
7 at least leave placeholders.

8 Again, I will cite this. I'm being a
9 little bit redundant to yesterday again, but we do
10 have in Part 50 PWRs and BWRs, and there are aspects
11 of PWR safety and BWR safety that are somewhat
12 different. The NRC is able to deal with that in a
13 consistent manner in its regulations.

14 MR. CAMERON: Okay. And by placeholder,
15 you mean a section of the regulations that would be
16 reserved for future development?

17 MR McCULLUM: Yes, a reserved section.
18 The page would say, "Reserved for...," and you would
19 give a title. You know, the title would tell you what
20 you are aiming to do there. You would wait until more
21 of it was known if it was for a less-matured
22 technology before you filled in the specific text.

23 MR. CAMERON: Okay, yes. Let's go to Ed,
24 Ed Lyman.

25 DR. LYMAN: Thanks. I would like to push

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1 back on the mantra of risk-informed. I don't believe
2 that at least in the initial stages of this rule that
3 it's possible or appropriate to use risk-informed
4 approaches, because if you can't calculate the
5 probabilities credibly, then you can't actually
6 determine the highest-risk events.

7 So, I think if you look at the analogy of
8 reactors, initially, there were, based on technical
9 judgment at the time, a list of design basis accidents
10 that was developed. And over time, as operating data
11 accumulated, you were able to modify your perception
12 of the highest-risk events through risk-informed.

13 But if you are starting with a very small
14 number of facilities with limited or no operating
15 experience, then a better approach would be for the
16 technical judgment of the staff to develop a set of
17 accidents which the licensee or the applicant would
18 have to demonstrate high assurance that they would not
19 occur. And over time, maybe the rule could be risk-
20 informed, but not initially.

21 The second point I would like to make with
22 regard to design criteria, I would like to throw out
23 one which has bothered me for a long time. That is
24 that there is no requirement for protection of fuel
25 cycle facilities against deliberate air crashes. Now

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1 we have a rule for reactors where there is a
2 requirement that you need to do an assessment of a
3 deliberate air attack and demonstrate some level of
4 performance in that regard, and there's no comparable
5 requirement for fuel cycle facilities. That is a
6 definite gap which needs to be corrected in this rule.

7 Thanks.

8 MR. CAMERON: Okay. Thank you. Thank
9 you, Ed.

10 Arjun, do you want to follow on that?

11 DR. MAKHIJANI: Just very briefly. I
12 didn't realize Rod was building a record of agreement.
13 I just want to say that, when I agree, I'll say so,
14 and when I disagree, I'll say so. So I don't want the
15 record to reflect Rod's statement about our mutual
16 agreement until I have agreed explicitly.

17 And I just want to say I agree with what
18 Ed just said.

19 MR. CAMERON: Okay, but thank you, Rod, in
20 the spirit of trying to build agreement, okay, Rod?

21 MR McCULLUM: And I will try to be
22 careful. And since we now have framed what is a
23 disagreement, I will try to again search for some
24 common ground or at least put my two cents in, as it
25 were.

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1 I don't think that knowing the problem,
2 and this is the one thing I think was the point of
3 disagreement with what Ed said, knowing the
4 probability is a prerequisite to being risk-informed.

5 I think what really needs to be risk-
6 informed, to understand the risk, it is really to know
7 and understand the hazards that exist. And then there
8 are multiple ways -- and we talked about some of those
9 yesterday -- that you can address those hazards.

10 But, really, if you start with an
11 understanding of the hazard, and also, with recycling
12 facilities, you are understanding that they're not
13 reactors, I think that does mean something here. I
14 think that should not be lost.

15 We start with an understanding of hazard
16 and a commitment that you're going to make a
17 regulation that will require an applicant to put in
18 place sufficient measures between that hazard and the
19 public and the workers to assure safety. I think you
20 can do it on a risk-informed basis.

21 Probabilistic risk assessment is one tool
22 for risk-informing. It is not necessarily the only
23 way to skin that cat.

24 MR. CAMERON: Okay. Ed, do you want to
25 follow up?

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1 DR. LYMAN: Yes, just briefly. I don't
2 think you truly understand the hazards unless you
3 understand -- I mean you can't risk-inform unless you
4 have a sense of the relative probabilities of
5 initiating events as well as the probability that they
6 carry through to a particular outcome.

7 So I just don't see how you can risk-
8 inform. I think, by definition, it means that you are
9 basing your analysis on some sort of a probabilistic
10 risk assessment. So I just don't see how it can be
11 done.

12 MR. CAMERON: And Sven?

13 DR. BADER: I think the simple answer is
14 that you would be very conservative on your
15 probabilistic assessment. Unless you're making an
16 event that is not credible, you consider them likely.

17 MR. CAMERON: Okay. John, you started us
18 off trying to answer a question that Alex put forward.
19 You have heard the discussion on risk-informed, and
20 we don't have enough information about probability to
21 do that. Sven just talked about being very
22 conservative.

23 Are there any lessons from the White
24 Paper, your thoughts on any of this?

25 DR. FLACK: Well, building a conservative

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1 PRA is really against the grain of it all because you
2 don't know what you have in the end. I think it comes
3 down to trying to understand what the uncertainties
4 are and having to deal with uncertainty. And risk can
5 go either way. It can show things that you find to be
6 important that you didn't know before, but it also
7 shows things that are not that important.

8 And it goes beyond just trying to come up
9 with numbers. It becomes a form of awareness by
10 developing a model, understanding what's in the model,
11 and understand the difficulties in quantifying that
12 model, and then having to deal with that.

13 This is all knowledge and information
14 about the technology, the facilities. You know,
15 unless it's abused some way or somebody has a
16 different agenda on how to use it, it's a search for
17 truth, and that's what it should be.

18 How far you can go with that depends on
19 things like data, you know, and understanding the
20 model, and understanding the hazards that are
21 intrinsic to it. You know, the likelihood of events,
22 the consequences are very important. Understanding
23 exactly, does this result in a significant consequence
24 or are these things not so significant? I mean it
25 goes either way.

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1 So I think arguing, you have to argue, I
2 think, for realistic analysis, as best you can do, and
3 then know what the limitation of the analysis is, and
4 then put that on the table with other decisions. Some
5 of them may be that we don't know the likelihoods that
6 well. We will need to develop certain accidents in
7 any case, just to be sure as a defense-in-depth.

8 But now you're off the board. Now you are
9 no longer thinking PRA. You're saying, okay, I took
10 it as far as I can go, these actions make sense
11 because I don't know enough. I have a large degree of
12 uncertainty around them, and we will have to design
13 the plant more conservatively.

14 But now you're outside the PRA, the
15 designing a plan now. So you really shouldn't mix up
16 the two. I wouldn't like to see us go down a road of
17 saying, you know, we can build conservatisms into the
18 PRA. You do it the best you can and you deal with the
19 uncertainties. I think that is all I could add to the
20 discussion really.

21 MR. CAMERON: Okay. Let's go to the
22 staff, to Marissa and then Yawar, and then we'll come
23 over to Steve. Marissa?

24 MS. BAILEY: I just have a question for
25 folks at the table to consider. That's, what role

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1 could guidance play here? There's a certain amount of
2 criteria, a minimum level of criteria that you could
3 specify in the regulations. But if you're looking for
4 a technology-neutral, performance-based, risk-informed
5 set of rules, that would be a limited set and you may
6 not want to get too specific.

7 So, is there a role for guidance? Could
8 you provide a certain level of specificity in NUREGs
9 or Reg Guides? That is where you sort of get away
10 from the technology-neutral piece and start to address
11 specific technologies.

12 MR. CAMERON: Okay. Rod, has the Task
13 Force thought about the relationship between the
14 regulations and the guidance aspect?

15 MR McCULLUM: Not specifically. However,
16 the short answer to Marissa's question of, is there a
17 role for guidance, I would say, absolutely, yes. I
18 mean we have looked at trying to be technology-neutral
19 in the regulation, and I think that is a good first
20 step, recognizing, as I talked about one way is
21 reversed sections. Another way is you could have a
22 different standard review plan for different types of
23 recycling facilities that you would develop in
24 accordance with the regulation later.

25 So, yes, without going on and on, I think

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1 the short answer is looking at keeping the regulation
2 itself technology-neutral and then bifurcating where
3 you feel you need to be more specific, as you know
4 enough to develop guidance. That might be a workable
5 approach for us. I think that would not be -- and
6 correct me; the authors are sitting around the table;
7 correct me if I'm wrong. I don't think that would be
8 inconsistent with what industry has proposed.

9 MR. CAMERON: Okay. Thanks, Rod.

10 Yawar?

11 MR. FARAZ: Yes, I just wanted to make a
12 point, in addition to what John was mentioning. I
13 mean you can do a fairly good accident analysis. You
14 can analyze the accidents to death. But there's
15 always this unknown.

16 As you get experience, as you learn more,
17 that unknown gets lower and lower, and this is in
18 addition to the uncertainties with what you have
19 already identified.

20 So, clearly, you need General Design
21 Criteria. You need operator training, and you need
22 margin to be able to address the unknown.

23 So I think the analysis that we do is
24 clearly needed, but, in addition to that, we need
25 these additional requirements which some would

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1 consider to be prescriptive to address that unknown.

2 MR. CAMERON: And those prescriptive
3 requirements could be unrelated to any particular
4 technology. They would be in what would be called
5 Basic Design Criteria or some other term?

6 MR. FARAZ: Well, many would be
7 technology-specific.

8 MR. CAMERON: Okay. Steve?

9 MR. SCHILTHELM: Backing up to what John
10 said, you know, we seem to keep falling into this,
11 there needs to be a PRA to be risk-informed and
12 drawing this alignment between PRA and risk-informed.

13 But I would agree with everything John said.

14 I think I could almost insert the words
15 ISA everywhere you use PRA because the exercise and
16 the understanding of the hazards and the rigor that
17 you put into understanding what you are trying to
18 accomplish with your safety profile, like you said, is
19 the important piece of the puzzle. It is not coming
20 up with a number or it is not coming with a term
21 called highly unlikely or unlikely. It is the
22 exercise and the rigor.

23 So I would like to decouple the notion
24 that somehow PRA is risk-informed and ISA is not risk-
25 informed. I think they are both a risk-informed

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1 process that will allow you to understand the risks
2 and hazards at your facility and make good decisions
3 about safety.

4 And like Yawar said, where you don't
5 understand or you have large uncertainties, that is
6 where you have to apply your conservatism and your
7 judgment. Whether you are doing PRA or ISA, there is
8 an element of judgment where you have either large
9 uncertainties or a lack of full understanding.

10 So I don't think they are that different.

11 I would like to kind of dispel the notion that PRA
12 and ISA are that different, and they can both be risk-
13 informed.

14 MR. CAMERON: I think that might be a
15 useful distinction, is that, whether you are talking
16 about using a PRA or an ISA, they are both risk-
17 informed. And maybe we are getting tangled up on what
18 exactly that term "risk-informed" means. Maybe we
19 have to dial it down a little bit, not capital letter
20 "RISK-INFORMED", but risk-informed generally.

21 Ed, I know you have something to say, but
22 I also would like to ask you a question. When you
23 talk about establishing the design basis accidents
24 deterministically, that would be a starting point for
25 you.

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1 Would you agree that the ISA, for example,
2 would be the way -- in other words, what's the
3 mechanism for that starting point of determining what
4 the design basis accidents are in terms of how the NRC
5 would actually formulate a regulation?

6 DR. LYMAN: I think the distinction here
7 is that, rather than having the applicants define
8 their own set of accidents, that it would be the staff
9 in the Office of Research that would use a more
10 comprehensive view and an approach which would be
11 fully accessible to the public.

12 So, again, rather than putting it in the
13 hands of the applicants, I think it is really the
14 judgment of the staff that should take a broad view,
15 look at the historical database, make a reasonably
16 objective determination of where the uncertainties
17 are, and define a reasonable set of accidents. I'm
18 just more comfortable with that being performed by the
19 staff than having it done ad hoc by the applicants.

20 MR. CAMERON: Let me get some --

21 DR. LYMAN: And of course, risk, you know,
22 it's going to play some role, you know, qualitative
23 judgments of risk. But the way risk is being used in
24 the agency, putting too much reliance on the absolute
25 values of numbers, like what's going on in the SOARCA

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1 study, for example, that's being too specific with
2 regard to actual risk values.

3 So, I mean, I think the staff would use
4 some sort of risk-informed judgment, but it wouldn't
5 be based on inappropriately specific numbers.

6 MR. CAMERON: Okay. We are going to go to
7 Arjun, but I would like to get some reaction from
8 people around the table to Ed's suggestion, including
9 the NRC staff who has to write this, about how they
10 think that might work, Ed's suggestion about the staff
11 should take the initiative in identifying what Ed
12 called a reasonable set of accidents, rather than
13 having the applicant come in with that set of
14 accidents for the staff to look at.

15 So let's go to Arjun, and then we will go
16 down to Rod.

17 DR. MAKHIJANI: Well, I just want to say
18 that I agree with what John Flack said earlier in
19 terms of, if you are going to do a probabilistic risk
20 assessment, you can't just put a number and claim it's
21 conservative. Even to do that, you have to understand
22 the mechanisms of the accident. It is much better to
23 be able to define not only your state of knowledge,
24 but, also, your state of ignorance. So then you know
25 what to do.

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1 Secondly, I think to say that PRAs and
2 ISAs are somehow both risk-informed is, to my view, a
3 misunderstanding of how we have used the term "risk"
4 in this business. If you are going to calculate a
5 risk, you need to know ultimately the consequences of
6 an accident and the probability, the two bottom-line
7 numbers in that process.

8 So, when you are talking about risk, you
9 know, so many cancers, so much radiation dose, so many
10 dollars of damage, there's a bottom-line number that
11 comes out of a product of two other numbers. And it
12 can only come out of one process. I think to
13 attribute other meanings to risk is simply to confuse
14 the issue.

15 You can have a safety analysis, fine,
16 which is what you were talking about. But to mix up
17 that safety analysis and then you might be able to go
18 back from a safety analysis and say, oh, now that I've
19 looked at 70 different chemical industries, I know
20 more about the probability of this accident which I
21 didn't know before. But, anyhow, you have to go back
22 to calculate that risk.

23 I would very strongly recommend against
24 mixing up the notion of risk, which is a product of
25 accident consequences and probability, with other

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1 notions of safety, even though both ideas are
2 important in designing something that one might call
3 safe in a regulation.

4 MR. CAMERON: Okay. Steve? Before we go
5 to Rod, Steve?

6 MR. SCHILTHELM: Just now I disagree. And
7 clearly, I don't think a number is totally necessary
8 to understand risk, because a number has a large
9 uncertainty bar, and a number stated without that
10 uncertainty bar is no better than a qualitative
11 statement of risk. So I would disagree that a number
12 is the metric.

13 DR. MAKHIJANI: So there's no
14 misunderstanding here, what I said was that, when you
15 calculate a number, it's obviously your best estimate
16 and there's always an uncertainty around that best
17 estimate. That's why I said, when you do risk, you
18 are not only defining your knowledge, you're also
19 defining your ignorance. And the bigger the
20 uncertainty, of course, the bigger -- and at a certain
21 point, the uncertainties are so big that you are more
22 ignorant than knowledgeable, and the middle number
23 loses its meaning.

24 So, just so I'm not misunderstood, I am
25 not talking about placing some kind of magical value

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1 on a number. I mean, you know, Ed spoke about that.

2 It is just that the reason I agreed with
3 what John said was, if you don't know it well enough,
4 then you have to do some supplementary or
5 complementary analysis to be able to understand your
6 problem better.

7 MR. CAMERON: And that complementary
8 analysis could be the integrated safety assessment,
9 such as was suggested, I think, by Steve.

10 DR. MAKHIJANI: Yes. All I'm saying is
11 don't mix it up with a very technical notion of risk.

12 At least if there's two notions of risk out there,
13 along with their uncertainty estimate -- the numbers
14 are calculated in particular ways, and if we are
15 mixing up other notions with that set of numbers, at
16 least I would like to know. So, then, I don't think
17 about the way NRC does risk in the way I've always
18 talked about.

19 Then maybe the NRC staff can comment on
20 that. At least it would benefit me a great deal.

21 MR. CAMERON: I'm trying to figure out
22 whether you two are on the same wave length here or
23 whether there's still a --

24 MR. SCHILTHELM: Well, I'm not sure we are
25 because, when the NRC implemented Part 70, they put

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1 forth a risk-informed regulation. And Part 70 in no
2 way tries to calculate a number. So the NRC, through
3 the implementation of Part 70, has at least another
4 paradigm for risk that doesn't have a number.

5 And while on the reactor side there's PRA
6 that produces a number, on the fuel side there's an
7 ISA that is risk-informed, as stated by the NRC, that
8 doesn't produce a number. So there is more than one
9 paradigm for risk.

10 MR. CAMERON: Okay. Let's go to Rod, and
11 then go to Alex.

12 MR. McCULLUM: Yes, and in some ways the
13 discussion has kind of moved past what I wanted to
14 say, but I think I can use what I wanted to say to
15 maybe weigh-in on this quantitative issue here.

16 I want to start out by agreeing with Ed.
17 I know Arjun doesn't like it when I agree with him --
18 (laughter) -- but I did want to agree with Ed, in that
19 the overreliance on a very specific number is not what
20 is useful here. I mean it is not important to know
21 whether it is 1.073 times 10 to the minus 7th or 1.074
22 times 10 to the minus 7th.

23 I will concede, however, the risk is
24 probability times consequences. Everybody in the room
25 knows that.

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1 The question is we absolutely have to know
2 the consequences. We have to know the hazards. The
3 question is, to what level of specificity do we need
4 to know the probability? That's how you can have a
5 Part 70 being risk-informed, in that I could take the
6 hazard of a facility being the fission product
7 inventory.

8 I could set the probability equal to one
9 that every single one of those fission products ends
10 up in this glass of water, and then the consequence is
11 I drink it. And obviously, if I was still alive or
12 safe, then there wouldn't be much of a risk there.
13 But, obviously, at some level that becomes untrue.

14 So the question is, then, how do I make it
15 unlikely that those fission products are going to end
16 up in my bottle of water? What measures do I put in
17 place between the hazard and the consequence so that I
18 may not be able to say it's 1.073 times 10 to the
19 minus 3 or 10 to the minus 7, but I can say that it is
20 sufficiently unlikely that the regulator can make a
21 determination that we have protected safety here. And
22 I think integrated safety analysis allows you to do
23 that.

24 So, yes, I think there is a way to
25 understand risk and to use risk insights without

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1 necessarily having to do a precise PRA. I think in
2 instances where you have reactor facilities where you
3 have decades of operating history on 104 of these
4 things, you can do PRAs, if not at that level of
5 precision, down to the third decimal point, in ways
6 that give you even higher confidence.

7 I think, given reactors versus
8 reprocessing facilities, you have the opportunity to
9 do more numerical analysis, and maybe you have a need
10 for numerical analysis. You have high-energy systems.

11 You have systems that are interdependent upon one
12 another to function, which you don't necessarily have
13 in reprocessing facilities.

14 I guess I wanted to turn back and, given
15 that, ask Ed a question, getting back to another
16 subject he raised. The idea of the confidence you
17 have in NRC specifying the accidents versus the
18 applicant, and I am wondering if this might not be a
19 level-of-detail issue.

20 I mean if NRC were to specify in the
21 regulations the accidents at some level of detail that
22 an applicant would need to analyze, but not in such a
23 level of detail that they become specific to a
24 technology -- and again, I will take criticality as an
25 example. The NRC could specify, you know, the

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1 criticality accidents without specifying them down to
2 a level of detailed systems that are unique to GE's
3 technology versus AREVA's technology, but specify some
4 pretty rigorous requirements as to requiring the
5 applicant in either case to evaluate a range of
6 criticality accidents.

7 Do you believe, Ed, that this could be
8 reduced to a level of detail that there could be a
9 comprehensive enough set of accidents specified in a
10 technology-neutral manner?

11 MR. CAMERON: Okay, Ed, what's your
12 response to that? In other words, when you are
13 thinking about the staff identifying these rather than
14 an applicant bringing them in, is Rod's suggestion
15 about the level of detail here or the generality that
16 the staff might use identifying certain types of
17 accidents, does that match up with what you're
18 thinking?

19 DR. LYMAN: I just don't think that
20 technology-neutral is an exalted principle that I
21 think would put constraints on what the staff is
22 doing, which may not be necessary or appropriate. I
23 mean it will fall out naturally that some events may
24 be common to a variety of technologies and others are
25 going to be technology-specific.

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1 I don't see the value of trying to ensure
2 that the regulation itself is technology-neutral. So
3 I think it would just fall out naturally, what events
4 were common to different technologies and what
5 weren't. But there's no sense in a priori saying thou
6 shalt not have anything in the rule that is
7 technology-specific.

8 MR. CAMERON: Any response on that, Rod?

9 MR. McCULLUM: Well, I would just
10 challenge the staff to think long and hard about, are
11 there accident scenarios where they feel they need to
12 be technology-specific? And I would say, if there
13 are, that they consider bifurcating and that they
14 consider the role that guidance might play. Consider
15 reserving sections for the less-mature technologies.

16 I mean it may very well be that you have
17 an accident scenario that Eric might say, well, for my
18 facility, that's not applicable, and in his safety
19 analysis, he would have to write an argument for why
20 that scenario is not applicable. The same thing might
21 happen for a different type of scenario for the AREVA
22 folks.

23 But I think there's room to find the right
24 level of assurance in there and be as technology-
25 neutral as possible. I think it is important to

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1 industry because -- and this is getting back to a very
2 high-level principle that we bring into the room here.

3 It is that recycling regulations are an input to
4 decisionmaking. In order for commercial entities and
5 my friend here from the DOE to make decisions about
6 moving forward with recycling, it helps to know what
7 the regulatory framework is. It is extremely
8 important. I'll give you an example.

9 I mean regulations on carbon will dictate
10 to the extent to which we are successful in capturing
11 it. And that is even outside the nuclear industry.

12 So we need to have a regulatory framework
13 we can use to make a basis for decisions, as the
14 commercial entities are trying to advance their
15 technologies and their customers are looking at their
16 technologies. What are the regulatory costs here?

17 And if you say that you can't be
18 technology-neutral, then you have a real chicken-and-
19 egg problem because you have something that will
20 inform decisions that is dependent upon the results of
21 those decisions.

22 So, again, to the extent there can be
23 reserved sections, there can be a role for guidance,
24 or there can be bifurcation, allowing us, the
25 industry, the customers of these technologies, and the

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1 Department of Energy to know as much as possible about
2 the regulatory framework before these decisions are
3 being made, which is of critical importance here.

4 MR. CAMERON: Okay. Thanks, Rod.

5 Alex, I know you have something to say,
6 but I also wanted to ask you and Marissa, Tom -- John
7 Flack started us off with talking about identifying
8 design basis accidents. We have had a lot of
9 discussion about that.

10 From this discussion of everybody, are you
11 getting a sense of how you would structure this part
12 of the regulation? And are there other specific
13 issues that you would like to ask the participants to
14 address in terms of what you need to formulate the
15 rule? Since you have them here, let's take advantage
16 of the opportunity.

17 MR. MURRAY: Well, let me ask the question
18 this way: if we go and look at the General Design
19 Criteria or Baseline Design Criteria that exists out
20 there in different parts of the regulations, I would
21 say probably at least 75 percent of them are
22 technology-neutral right off the bat. And I would say
23 maybe, if one took a very top-level view, maybe the
24 majority, even all of them, could be made technology-
25 neutral in entirety.

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1 Having said that, you know, if you look at
2 some of the General Design Criteria, we are dealing
3 with irradiated materials. Some irradiated materials
4 are self-heated. There's a General Design Criteria in
5 Part 50 that says, you know, you should have a cooling
6 system for -- I think it actually uses the term "the
7 reactor". But for a reprocessing facility, if you
8 substitute, instead of "reactor", you say you should
9 have a cooling system for self-heating materials, and
10 say that's a requirement, a General Design Criteria or
11 Baseline Design Criteria in the regulation, does that
12 not lead to, if you will, applicants to consider
13 evaluating overheating-type accidents?

14 If you have a requirement, a General
15 Design Criteria or a Baseline Design Criteria for an
16 emergency cooling system for irradiated materials or
17 materials that are self-heating or areas of a
18 reprocessing/recycling facility where materials can
19 self-heat or overheat, does that not lead or direct
20 the applicant towards evaluating accidents that are
21 associated with that? Cannot these specific types of
22 accidents, which might be associated with those areas,
23 say loss of cooling, can they not be fleshed out in
24 some form of guidance, be it a Standard Review Plan or
25 a Reg Guide for specific technologies? I throw that

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1 question out there.

2 There are requirements for, I should say,
3 I'll use a GDC/BDC for control room areas. Those are
4 essentially technology-neutral. There shall be a
5 control room area or control area, I believe is how it
6 is phrased, and those are fleshed out in guidance, you
7 know, what the staff would envision those areas might
8 have. It might be habitability, specific requirements
9 for operating under accident conditions, et cetera.

10 And I throw it out as a question. Can
11 some of these minimum requirements be general in the
12 rule and specific in the guidance? You know, there
13 are some things we know. We know, as I say, loss of
14 cooling is an important thing to consider. We know
15 loss of criticality controls are important things to
16 consider.

17 Is there not a list that the staff can put
18 together with input from everybody here, input from
19 members of the public, comments, and have it revisited
20 at a later date in the rulemaking, and we can go from
21 there?

22 They will lead towards ultimately
23 consideration of design basis accidents. It can also
24 feed into risk-informing of various types.

25 Okay, gee, if I have self-heating

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1 materials in this area and I lose the cooling, what
2 are the probabilities of that happening, if you wanted
3 to go down to a PRA rule, for example? Can it be
4 binned using an ISA methodology? Again, I throw these
5 things out.

6 I do want to comment on one thing that I
7 heard earlier about the focus on numbers and safety
8 analysis. Okay? I think Rod sort of touched on it a
9 little bit.

10 Whether we're at the numbers 1.073 or
11 1.079 times 10 to the minus 4 is sort of unimportant.

12 Okay? There's something about, I'll say, relative
13 order of magnitude. Is it 10 to the minus 1 or 10 to
14 the minus 5? Those are fundamentally different. How
15 you approach those are fundamentally different.

16 When you start getting much beyond, I will
17 say, I will use the term, reliability, which is a
18 little -- we will just call it probability of a system
19 functioning better than, say, 10 to the minus 2 per
20 year. You know that is a pretty darn good system and
21 has to have certain attributes to it. Okay?

22 So I think take a step back and think in
23 the big picture when you start talking about
24 methodologies. You know, we essentially have
25 quantification in many of these areas. The ISA, Part

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1 70, its development was to some degree quantified or
2 based upon quantification, even though it does not
3 require a quantified methodology.

4 Enough said. I've spoken enough. Thank
5 you.

6 MR. CAMERON: Okay. Let's hear from Phil
7 and Yawar, and then go to Steve and over to Ed. Phil?

8 MR. REED: I just wanted to make a general
9 comment and then respond to what somebody else has
10 said.

11 With regard to the PRA, now internally
12 when you do PRA, you do get results, and some of these
13 results tell us we don't have to spend time on this or
14 that; we don't have to spend resources on this and
15 that. Let's concentrate on what's the most important.

16 And one of the beauties of PRA is, if you
17 do get small numbers in these areas, that's the end of
18 the discussion. You just concentrate eventually on
19 what's the most important part.

20 There was a comment made with regard to
21 aircraft impacts. And indeed, the staff has discussed
22 this extensively for reprocessing plants. And I
23 believe at the last public meeting, I think Alex
24 presented a slide on the GDC, and I believe aircraft
25 was presented there. So the staff discussed this,

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1 essentially.

2 There is one area of external events that
3 has sort of come up by a number of people, and I think
4 it was mentioned at the RIC conference. That's if
5 we're going to go continually to digital I&C and
6 computerization, the questions come up about cyber
7 security. And I think the issue has been framed
8 around, is cyber security a General Design Criteria?
9 We haven't heard too much about it. Maybe with the
10 folks we have here, maybe we can get a few comments on
11 that.

12 But it is an external event, like
13 aircraft. It's not the internal events that we're
14 concerned about here. But I just wondered what people
15 thought about that.

16 MR. CAMERON: Okay. Two specific things,
17 follow-up on Ed's suggestion or comment on aircraft
18 impact, cyber security. We'll go to all of you to see
19 what you have to think about that.

20 Marissa, go ahead.

21 MS. BAILEY: Just maybe to broaden Phil's
22 question a little bit, Phil, are you basically asking,
23 then, is intentional, malicious actions something that
24 ought to be considered in the General Design Criteria?
25 Because when you start talking about intentional

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1 aircraft crashes and cyber security, that's kind of
2 what you are getting into.

3 MR. REED: Yes, I would consider them to
4 be two separate events. The aircraft impacts,
5 strictly analogous to the way we do reactor regulation
6 in the Reg Guide.

7 And with the other one, it is sort of a
8 little bit nebulous because we aren't too sure how to
9 really deal with it. It's a term that has been used
10 around, but it is hard to get a specific handle on how
11 you do it. But as long as we are going to go to
12 control rooms and functions of the plants that are
13 more computerized today, which we did not have back in
14 the seventies or eighties, these types of questions
15 come up.

16 With the reprocessing plant, we have to be
17 very careful. You have all the fission products,
18 transuranics going around. So there may be something
19 here that could cause a problem and, if so, should it
20 be considered a Design basis Criteria, is basically
21 what we are asking.

22 MR. CAMERON: Okay. Thanks, Marissa, for
23 putting that out there. The question is, should
24 category conventional malicious acts be a General
25 Design Criteria for these reprocessing facilities? So

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1 it would be useful to get some comment on that.

2 Yawar, what's on your mind?

3 MR. FARAZ: I wanted to go back to what
4 was suggested, that the NRC come up with a list of
5 accidents that need to be analyzed.

6 For a complex fuel cycle facility,
7 clearly, to come up with a set of accidents
8 representative of that facility, you would need to do
9 a very thorough hazards analysis, go through and
10 identify all the hazards, and then from those hazards,
11 develop the accident sequences. That is something
12 that an applicant or a licensee is more suited to do.

13 And what the NRC has been doing under the
14 ISA requirements is the NRC looks very closely at the
15 process that the applicant uses or the licensee uses
16 to identify the accident sequences.

17 The way I see it is, for a fuel cycle
18 facility, the biggest thrust you get in ensuring
19 safety is identifying all potential accidents. The
20 problems that have occurred have not been in the areas
21 or have not been accidents that have been identified.

22 They have been situations that have been overlooked.

23 So a thorough and a very complete
24 identification of potential accidents needs to be
25 done, and that can only be done by a very thorough

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1 analysis.

2 So, although I see the benefits of coming
3 up with a list of accidents that need to be analyzed,
4 there's also this danger of the focus shifting from
5 doing a very thorough hazards analysis and starting
6 from the bottom up, to identify accident sequences,
7 which is working your way down by looking at the
8 accidents that have been identified and then working
9 your way down and not paying much attention to the
10 hazards analysis that really needs to be done for any
11 fuel cycle facility.

12 MR. CAMERON: Okay. I think Rod, in
13 trying to be responsive to Ed's suggestion on the NRC,
14 specifying the type of accidents that should be
15 considered, said that the NRC, it might be useful for
16 the NRC to set general categories, like criticality,
17 whatever. For example, I suppose that conventional
18 malicious actions or intentional -- yes, conventional
19 malicious actions, okay. Intentional malicious
20 actions would be one of those categories perhaps.

21 Are you suggesting that that might drive
22 whoever is doing the analysis to ignore, to overlook
23 something that would be important?

24 MR. FARAZ: What I was saying was, I was
25 saying that there might be a lot of reliance given to

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1 the accidents that were identified. For example, if
2 it's overheating of a tank containing liquid high-
3 level waste, the focus might be on that accident
4 sequence itself. For instance, there might be other
5 sequences that might be related to that event where
6 the focus might shift from those areas. So there
7 might be a potential of missing accident sequences
8 that really need to be considered.

9 MR. CAMERON: Okay. Alex, go ahead.

10 MR. MURRAY: Yes, I just want to elaborate
11 and agree with the analysis. We seem to be in a
12 little bit of a love fest right now, I think, at the
13 table here.

14 MR. CAMERON: It's sort of a strange love
15 fest.

16 MR. MURRAY: A strange love fest, yes.

17 I do think it is very important for a wide
18 net, so to speak, to be cast for accidents and
19 accident analyses. A very good case in point is what
20 happened at Thorp where they had a leak from a tank.
21 The safety analysis had evaluated and considered the
22 tank being 100 percent full and everything was
23 copasetic when the tank was 100 percent full. The
24 analysis did not consider the tank being half-full.

25 And for various reasons, the operators

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1 decided, well, we're going to go through some batches
2 and we're only going to fill the tank half-full, and
3 they never put two and two together that this was an
4 unanalyzed situation. And because of that unanalyzed
5 situation, various phenomena occurred which resulted
6 in a leak, and the leak was significant. It's on
7 various websites, various reports are out there, and
8 so forth.

9 Now there's also a corollary to that,
10 which I think we need to keep in our mind. The plant
11 had, for want of a better term, a General Design
12 Criteria that cells should be lined with stainless
13 steel. Okay, there is no risk-informing basis for
14 that. It is just, hey, this is a good practice; this
15 is something we should do as a minimum criteria.

16 They did that, and even though 25,000
17 gallons of highly radioactive materials leaked out,
18 because it went into basically a stainless steel-lined
19 cell, the consequences were essentially nil to the
20 workers and the public.

21 So you had two parts there. Something
22 where the analysis was incomplete, but where a minimum
23 or General Design Criteria rendered the effect of the
24 incomplete analysis to be essentially moot. And I
25 think we have to keep that in balance as we keep

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1 discussing this.

2 Thank you.

3 MR. CAMERON: Okay. Let's go to Steve and
4 Tom and back to Ed, and I think we are getting towards
5 break time here.

6 Steve?

7 MR. SCHILTHELM: To go back to what Alex
8 originally said about General Design Criteria or
9 Baseline Design Criteria, whichever you want to call
10 it, I think if you look back in the regulatory history
11 and you look at what we offered, the design criteria
12 can be a broad set of criteria, but it is not a static
13 list. As things are learned, you can add to design
14 criteria. As technologies emerge, you can add to
15 design criteria.

16 So, if you think of them as a broad set of
17 criteria, not every criteria will apply to every
18 facility. Even in Part 50, I think there are some
19 criteria that don't necessarily apply to both BWRs and
20 PWRs. But if you think of the criteria as your broad
21 set of overarching criteria that is a more living
22 appendix maybe than Part 50 has been, there might be
23 an opportunity there to stay technology-neutral but
24 allow the regulation in the design criteria piece to
25 grow with growing technologies.

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1 If you look at Part 50, technically,
2 design criteria are not requirements; they are
3 criteria to be considered. And you have to describe
4 how they are considered and how they are executed.

5 And if you keep that concept in mind,
6 there might be an opportunity to have a technology-
7 neutral regulation that has a broad enough set of
8 design criteria that gets you to where you need to be.

9 MR. CAMERON: Okay. Thank you, Steve.

10 Tom?

11 MR. HILTZ: Thanks, Chip.

12 I just wanted to share some thoughts I had
13 about the conversation this morning and where I know I
14 might benefit from additional discussion, whether it
15 fits in today or at our forum in Albuquerque.

16 When I read about events or operational
17 occurrences at reprocessing facilities, it seems like
18 almost everything that happens is referred to as an
19 accident. I think it would be helpful to have a
20 common understanding about what an accident is at a
21 reprocessing facility.

22 My understanding of risk at a reactor is,
23 you know, the accident you are trying to prevent is
24 core damage frequency. Here we may have a series of
25 things that we're trying to prevent or more than one

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1 thing.

2 But I think it is important to understand
3 that maybe a fire at a reprocessing facility isn't an
4 accident. I mean, you know, a fire at a power plant
5 isn't an accident.

6 So, as I read the literature and I think
7 as we try to communicate to the public, we probably
8 ought to be very clear about what we mean when we
9 refer to the term "accident". I think we also
10 probably need to have sort of a common understanding
11 of hazards and risks because it seems like we have
12 sort of the discussion, we are still trying to wrestle
13 with, I think, a common understanding of those terms.

14 I think I'm not sure I see big concerns or
15 big issues with a process that may stipulate certain
16 accidents, whether they are generic in context or, if
17 we're smart enough at the time to write the rule, to
18 be more specific.

19 I think it is important to understand that
20 we can perhaps develop a regulation that says you have
21 to prevent and mitigate this, these actions, but how
22 you do that might be up to the individual applicant to
23 describe and for the NRC to review and approve.

24 We have been talking about risk-informed
25 in the context of design. I would encourage us to

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1 think about risk-informed in the concept of operation,
2 too, and once we stipulate something or once we design
3 something, how we are going to use risk to help
4 operate the facility safely.

5 I certainly would sort of want to
6 understand a little bit more about the stability that
7 I understand I hear from the industry about we need a
8 licensing framework in place. I can't help but wonder
9 whether we need to not broaden that to make sure that
10 it is a regulatory framework in place.

11 Because if we have such broad generic or
12 general criteria by rule, I think by necessity we are
13 going to have an important place for guidance. Are we
14 sort of mortgaging those discussions so that we can,
15 at a later point in the process, after we get a
16 license, as opposed to providing some overarching
17 regulatory stability, which I think is a bigger subset
18 of the licensing stability?

19 So those are some of the thoughts that I
20 had as I heard the discussion.

21 MR. CAMERON: Okay. Thanks. Thanks, Tom.

22 Let's quickly go to Ed and Rod, and let's
23 take a break.

24 We want to touch base with the people in
25 the audience, too. But I guess I would ask you to

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1 think about the discussion. We have covered a lot of
2 ground there.

3 When we come back, eventually we need to
4 get to our scheduled waste agenda item at 11:00. But
5 when we come back, we are going to go to the audience.

6 I would just ask all of you around the
7 table, what's the most important, salient point that
8 you would like to make on this design operational
9 agenda item? And we will get those on the record and
10 move on from there.

11 But, Ed, and then Rod, and then we'll take
12 a break.

13 DR. LYMAN: Thanks.

14 Just to touch on two points that came up:
15 one, regulations versus guidance, I think we would
16 caution against farming off too many substantive
17 issues to guidance because, first of all, guidance
18 doesn't operate under the same rules of notice and
19 comment as the rule does. And second, most of the
20 guidance these days seems to be written by NEI anyway.

21 Then, by enabling them to write the first draft of
22 every guidance document gives them inappropriate sway
23 over how the outcome of that document turns out. So I
24 would be hesitant about farming off too much to
25 guidance.

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1 Also, guidance documents, there's a bigger
2 chance that they would end up being marked OUO, as in
3 the case with some guidance already. So my concerns
4 about secrecy might be greater in that case.

5 The second point with regard to cyber
6 security, maybe we should defer this to the safeguards
7 and security discussion, but that does raise the issue
8 of safeguards and security by design. Right now,
9 there is no requirement that safeguards and security
10 issues be considered in the design of fuel cycle
11 facilities. In fact, in the case of the MOX plant, it
12 was the NRC's position that safeguards and security
13 are not designed, should not be taken into account in
14 the design. That was the OGC position.

15 That's in conflict with the Department of
16 Energy's statements about how safeguards and
17 securities should be fundamentally considered in
18 design. So I would think that cyber security as well
19 as all other potential adversarial tactics need to be
20 considered as General Design Criteria.

21 Thanks.

22 MR. McCULLUM: And, Chip, since we do want
23 to get to a break, I will just be very brief here.

24 The reason I raised my card, I just wanted
25 to compliment Tom on his excellent summary. I think a

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1 lot of what I think are the salient points of this are
2 wrapped up in there.

3 I agree, I think what we want really is a
4 regulatory framework. I think we want to be as
5 comprehensive as possible because, again, it is in our
6 interest at the front end of decisionmaking to have as
7 much regulatory certainty as we possibly can.

8 I think we have heard a lot, NRC has
9 gotten a lot of food for thought here. Clearly, there
10 may be a role for guidance, but, as Ed has just said,
11 I think that there needs to be an appropriate balance
12 between what goes in guidance and what goes in
13 regulation. I don't want to see everything mortgaged
14 to some future poor licensee down the road who doesn't
15 know things in the upfront.

16 And there's a balance between how much we
17 can develop in terms of that regulatory framework
18 without crossing past technology-neutral and how much
19 we can leave in placeholders and things like that.

20 So I guess my summary, again, I just
21 wanted to compliment Tom for that and say I think
22 balance is the key.

23 MR. CAMERON: Thank you. Thank you, Rod,
24 Tom.

25 Let's take a break. Come back around

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1 10:30, have a little bit more discussion on this,
2 including with those of you in the audience. Then, we
3 will move to the waste agenda item at 11:00.

4 (Whereupon, the foregoing matter went off
5 the record at 10:14 a.m. and went back on the record
6 at 10:37 a.m.)

7 MR. CAMERON: We're going to try to wrap
8 up here, so we can go on to the waste issue, and Mike
9 Lee is here with us to tee that up for us.

10 And we're going to go to the audience.
11 But I think Tom, once again, as he did yesterday, sort
12 of gave a nice a summary of what the NRC staff needed.

13 But I would just like to give anybody who wants to
14 volunteer, after listening to that discussion, one
15 perhaps insightful, important to you comment for the
16 NRC staff to consider on this particular area in terms
17 of the technical basis for the rulemaking.

18 I know that Jim Bresee from DOE has
19 something to say. You don't have to say it now, but
20 you can. Okay, Jim Bresee.

21 DR. BRESEE: Thank you, Chip.

22 I wanted to interject a note of optimism
23 with regard to future design criteria. That is that,
24 at the moment, within our research and development
25 program, there's a good deal of active collaboration

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1 between the modeling and simulation staff and the
2 experimental research and development programs that I
3 think offers some real potential for reduced
4 uncertainties in future safety analysis.

5 I'm, of course, in danger of being overly
6 optimistic, but I think there are tools being
7 developed in the areas of modeling and simulation
8 that, to me, offer some real potential in future
9 systems for a detailed analysis of safety issues.

10 To the extent that this may provide more
11 incentive for generic standards at the moment, to be
12 modified later by additional criteria coming out of
13 the research area, the one thing that has
14 significantly changed over the past year within the
15 separations areas of DOE has been an extended time
16 table. There is no question that, as between GNEP's
17 ambitious efforts to have commercialization within the
18 next 20 years and the present time table we are
19 discussing, that there has been an extension of our
20 program, and thereby, more opportunity for this type
21 of collaboration I was mentioning to take place, not
22 only on an analytical basis, but on an experimental
23 basis.

24 We are actively seeking now ways in which
25 improved modeling can be applied to existing plants

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1 allowing us to test their effectiveness, and thereby,
2 provide a basis for pilot plant testing of the same
3 criteria later. I think that this is an area of
4 rather rapid change which could have a significant
5 long-term impact on the NRC regulatory environment.

6 So I would only offer this note of
7 optimism: that I think our ability to reduce
8 uncertainties in safety analysis has a considerable
9 growth potential in the near-term. I'm saying over
10 the next 10 to 20 years, that this can provide a very
11 effective analytical tool as well as a basis for
12 regulatory design.

13 MR. CAMERON: Thank you very much, Jim,
14 for that note of optimism and, also, what it means in
15 terms of establishing criteria at this point.

16 Anybody else want to offer anything, their
17 perspective on the discussion that we had so far?

18 I'm just remembering Tom's point about we
19 are talking a lot about design, but this is also
20 operational considerations.

21 Anybody else on this or should we just go
22 to the audience?

23 Okay, Alex. Okay, go ahead.

24 MR. MURRAY: Hi, Chip. It's me again.

25 MR. CAMERON: It's you again, yes. He

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1 sort of pops up out of the box waving his tent. Alex
2 is here. Okay.

3 (Laughter.)

4 MR. MURRAY: I will just add one thing
5 that I encourage members at the table, members of the
6 public to keep in mind. Much of the discussion we had
7 this morning did keep coming back to safety and risk
8 analyses, but I think we need to keep in mind and
9 consider that there are minimum requirements for these
10 facilities or there could be minimum requirements for
11 these facilities. I think a very reasonable question
12 is, what are those? What level of detail should be in
13 those minimum requirements, be they General Design
14 Criteria, be they categories of technical
15 specifications, and what have you?

16 We didn't really get a good discussion of
17 that this morning. So I encourage people to submit
18 written comments on those.

19 Thank you.

20 MR. CAMERON: Okay. Thanks, Alex, and
21 perhaps something that we can specifically flag for
22 the Albuquerque discussion, too. Thank you.

23 Miriam, do we have anybody?

24 MR. HILL: My name is Richard Hill. I
25 work with ERIN Engineering. We are the largest PRA

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1 firm in the United States and probably in the world.

2 I thought maybe you would like to hear
3 some comments from a practitioner of PRA. I realize it
4 is not necessarily related to the particular topic,
5 but it has bled over from yesterday.

6 And I'm letting Miriam hold the microphone
7 because I would like to be able to read my notes, and
8 my Parkinson's will keep me from either shaking the
9 microphone or shaking my notes, and I would prefer to
10 be able to read them.

11 So PRA is both quantitative and
12 qualitative. That is the definition that is given in
13 the ASME standard for PRAs. It is an ASME/ANS
14 combined standard. We have to realize that it is both
15 qualitative and quantitative.

16 So ISA really isn't under the umbrella of
17 a PRA. I don't want this PRA to be a big, bad boogie
18 man that scares everybody because it's not.

19 An ISA is simply a little more
20 qualitative. We used SMAs, Seismic Margin
21 Assessments, for a long time, and still are using
22 Seismic Margin Assessments for seismic events and
23 gaining risk insights out of those. That's a
24 qualitative assessment, more qualitative than a full
25 seismic PRA.

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1 So, just with that concept in mind, risk
2 insights are obviously able to be drawn from an ISA,
3 and that's appropriate. And those insights can be
4 used in design as well as in operation. And those are
5 comments that were made.

6 PRA capability or ISA capability is going
7 to be dictated by several factors, one of which is the
8 lack of conservatism in the more realism you have.
9 For assessing the capability of a PRA, you have to
10 have it be realistic. The more conservatism you put
11 into it, the less capable it is. This is very clear
12 in the ASME and ANS standards, which the NRC has
13 recognized and endorsed in Reg Guide 1.200.

14 Also, completeness needs to be in there.
15 The more complete the evaluation and the assessment,
16 the better the capability of it. So the comments that
17 I heard about using conservatisms, that's appropriate
18 in deterministic design. It's not appropriate in a
19 PRA or in an ISA.

20 In general, the PRAs that are being
21 performed have metrics of core damage frequency and
22 large early release frequency. Those are for
23 reactors. Those do not make any sense. Those are for
24 Light Water Reactors. They do not make sense for gas
25 reactors, and we are in the process of trying to

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1 develop a standard for doing PRAs on gas reactors
2 where there is no core melt, and it will go directly
3 to a release. And you come up with new metrics.

4 It is very difficult, even though we have
5 a lot of experience with reactors, to try to develop a
6 highly-quantitative approach for a metric of radiation
7 exposure to workers or to the public or chemical
8 exposure to workers or the public. It would be very
9 difficult. It would be difficult to try to just jump
10 right into that.

11 So my recommendation from a PRA
12 practitioner's standpoint is start with something you
13 already have, you already know, which is the ISA,
14 which is the more qualitative PRA, and then work as
15 you gain more experience and more capability to a more
16 quantitative approach.

17 So that's my comments. Oh, and one other
18 comment, I guess.

19 You have been talking about aircraft
20 impact analysis. I am looking forward to that because
21 our firm also developed the methodology for the Bravo
22 Five Bravo evaluations post-9/11 of aircraft and large
23 fires and explosions.

24 We did evaluation for all of the plants in
25 the United States. We did the methodology and the

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1 application of the RAMCAP evaluation for the
2 Department of Homeland Security that NRC has looked
3 at. We are also doing the evaluation for almost all
4 of the aircraft impact assessments for new plants. So
5 I would like to get into that little subject, if you
6 get there.

7 Thank you.

8 MS. JUCKETT: Thank you.

9 Other public comments?

10 MR. LYONS: I'm John Lyons. I work at
11 Westinghouse, but I don't represent them. These are
12 all just my views.

13 As for Alex's comment on minimal
14 requirements, reprocessing, I feel like you guys are
15 leaning toward reactor. I feel like it should be more
16 chemical-based because that's all what reprocessing
17 is.

18 So we have lots of experience with
19 aqueous reprocessing and non-aqueous, or not
20 reprocessing necessarily, but chemical processes. For
21 example, the Bhopal disaster, that was non-aqueous.

22 Sorry, I'm a little nervous.

23 But I feel like we have disasters with
24 leaks and other things that are chemically very
25 hazardous, and you could take from that and use those

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1 minimal requirements to lean towards the nuclear side
2 as well, because this is all chemical. I mean there
3 is coming out of the criticality risk and self-
4 heating, it's all chemical. And even with self-
5 heating, we have exothermal reactions that are also
6 self-heating. So, as for minimal requirements, I feel
7 like we should go towards the chemical side of it.

8 And that's all I have. Thank you.

9 MS. JUCKETT: Any other comments?

10 (No response.)

11 Okay.

12 MR. CAMERON: All right, thank you. Thank
13 you, Miriam.

14 Let's get into our next topic, which is
15 potential waste management issues for reprocessing
16 facilities. We have Mike Lee from the NRC staff or?
17 You can't say the whole thing, either. No one can.
18 We're all challenged on that. Okay, so maybe someday.

19 It's just as well we didn't have that on this
20 transcript.

21 Mike Lee, go ahead, Mike.

22 MR. LEE: Thank you, Chip.

23 Good morning. Thank you for the
24 opportunity to address this group of people here
25 today.

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1 Let me say, from the outset, I'm "the
2 beard". I represent a team, and this team is focused
3 on two of the gaps that many of you may already be
4 familiar with in terms of the reprocessing effort
5 underway related to the definition of what incidental
6 waste might be and then how to classify it.

7 Part of the team that I participate in is
8 also represented by Phil Reed, who is here today, as
9 well as Wendy Reed. Nishka Devaser, who is also in
10 FSME, isn't here today, but he's also part of the
11 team.

12 One of the challenges I have been hearing
13 over the last day or so is there is a strong desire to
14 write a technology-neutral rule. But in developing
15 that rule, one of the issues that needs to be
16 addressed is the waste stream that comes out of this,
17 any reprocessing effort.

18 Historically, the wastes have been defined
19 by exclusion or source. There's histories that have
20 been written on this by Kocher, Croft, Lowenthal.
21 Most recently, Mike Ryan of the former ACNW wrote a
22 history, I think, in NUREG 18.53 which reviews how the
23 waste classification, respective waste classification
24 systems have come about, focusing on high-level waste,
25 spent fuel, TRU, greater-than-Class-C, low-level

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1 waste, and most recently, DOE waste incidental
2 reprocessing.

3 I think if you look at the old Federal
4 Register notice related to definition of high-level
5 waste or greater-than-Class-C, one of the things the
6 Commission noted is that the regulatory definition
7 implies a manner of disposition. So, if you define
8 waste in a certain way, that implies it is going to be
9 managed in a certain way.

10 And one of the challenges, like I said
11 before, that the team has is to get its arms around
12 what kind of waste might be coming out of a
13 reprocessing facility. Then, after you have an
14 appreciation for the quantities and concentrations and
15 physical properties and the like, then what's the most
16 appropriate way to manage those wastes?

17 So I think it has been said repeatedly
18 that the staff is still collecting information.
19 There's no particular view on how incidental wastes
20 are to be disposed of or how they are to be defined.

21 So I have before you a series of slides
22 that are only intended to promote discussion, and they
23 are only intended to be representative of just an
24 example that we currently have of how a reprocessing
25 facility works and the type of stuff that comes out of

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1 it.

2 So, if we can go to the next slide,
3 please?

4 As I mentioned before, the staff is
5 interested in developing a rule that is ideally
6 technology-neutral. But, nevertheless, the only
7 reprocessing process I think that is currently in
8 place or has been demonstrated is the PUREX process.

9 This slide is just to point out a couple
10 issues or aspects of that process. I would just like
11 to skip to slide 3, which I think is where the action
12 is, which is a mass balance type of arrangement.

13 And if you look at the lower righthand
14 side of the slide, those are the types of waste
15 streams that currently, I believe, come out of the
16 PUREX process. And if we were to look at those waste
17 streams, the existing regulatory framework is adequate
18 in classifying those waste streams.

19 So you know that, for example, high-level
20 waste is managed under 10 CFR Part 60 and Part 63.
21 Greater-than-Class-C is currently recognized under 10
22 CFR Part 61, which is NRC's low-level waste
23 regulation, but defers to DOE to manage those wastes.

24 And those wastes are to be disposed of, I
25 believe, in a deep geologic repository or in a

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1 facility approved by NRC, or the waste can be low-
2 level wastes, which are currently managed under 10 CFR
3 Part 61.

4 Just as a footnote, the Commission has
5 directed the staff to identify some ideas or proposals
6 on how it might risk-inform Part 61, if it was to
7 start over again. So, in some ways, the low-level
8 waste regulation, which may be the workhorse, if you
9 will, for the management of reprocessing wastes, may
10 be undergoing some revision or proposed suggestions
11 for revision over the next couple of years. So I
12 think that is just something to kind of keep in mind.

13 Moving on to slide 4, the waste streams
14 that I alluded to in the previous slide are primarily
15 either high-level waste or low-level waste or non-
16 high-level waste, if you will. And as we have already
17 mentioned, there's a framework in place for managing
18 those wastes.

19 Currently, that framework, again, just by
20 virtue of its history, low-level waste, for example,
21 is everything that is not high-level waste or not
22 greater-than-Class-C waste or not TRU and not spent
23 fuel. So you have kind of this patchwork of
24 regulations, if you will, that provide management
25 solutions for the various waste streams.

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1 On slide 5, this is just some language
2 from existing NRC regulations that talk about what
3 high-level waste is and what spent fuel is. This
4 information is available on the web and in the Code of
5 Federal Regulations. It's pretty straightforward.

6 Moving to slide 6, if you look at the
7 PUREX process, there's waste streams -- I'm not a chem
8 engineer; many of you are, I'm sure, and know more
9 about this than I do. But these are the types of
10 wastes and materials that are likely to be subject to
11 some kind of disposition.

12 So, as the staff gives consideration to
13 what might be included in a reprocessing rule with
14 specific reference to these waste streams, this is
15 fodder, if you will, for consideration.

16 Moving to slide 7, of course, there's
17 going to be some low-level waste or low-level-like
18 wastes. And this is an example or these are examples,
19 if you will, of the types of products or waste streams
20 or materials that might be managed under a Part 61
21 type of disposal regulation.

22 Slide 8 is just a continuation of examples
23 of additional materials that may need disposition
24 paths, and therefore, they will need to be classified
25 in any reprocessing regulation, we believe.

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1 So slide 9, as I said from the outset, is
2 -- and some of these points have been discussed
3 earlier; some of these points are currently under
4 consideration by the staff in other regulatory
5 context.

6 So, I don't know, Chip, how you want to
7 proceed with this. Start with the roundtable, I
8 guess, or I guess maybe I should ask Wendy or Phil if
9 they have anything else they want to offer before we
10 move along.

11 MR. CAMERON: Wendy is right back there.

12 MR. LEE: Raise your hand. There we are.

13 MR. CAMERON: Hi, Wendy. Phil?

14 MR. LEE: I would encourage, though, if
15 anyone has any views regarding things that the staff
16 should think about as we give consideration to how to
17 classify these waste streams or waste streams that may
18 come out of a reprocessing rule, I believe there's a
19 docket. We would encourage you, in addition to any
20 verbal comments you give us today, to send us your
21 written comments.

22 MR. CAMERON: Thanks for that, Mike, and
23 we have some issues there. But what's the biggest
24 challenge facing the NRC staff in terms of what they
25 need to have in a rule in terms of waste management

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1 from reprocessing facilities? Can you tell people a
2 little bit specific about what are you people
3 wrestling with?

4 MR. LEE: And I would ask Phil and Wendy
5 to pitch in on this as well. But I think one of the
6 biggest challenges is, given that we really don't know
7 which chem engineering process or fuel cycle process
8 the rule is going to be developed around or what it
9 might correspond to generically, it is hard to get a
10 feeling for what types of waste streams specifically
11 would be subject to regulation. I don't know if I put
12 a sharp enough edge on that.

13 But, Phil?

14 MR. REED: I think that summarizes the
15 overall picture. I think the practicality is just
16 getting down to the definitions, like a definition of
17 where, you know, high-level waste, but it is not
18 suitable for a repository; therefore, where does it
19 go? If it meets Part 61 requirements, well, fine, you
20 can put it into a shallow-land burial, things like
21 that.

22 I think the other thing is specifics.
23 What kind of waste comes from the AREVA processes
24 versus the Energy Solution. Now we tried to address
25 this in our first Commission paper. We actually had

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1 the two types of reprocessing, the type that would go
2 for the MOX facility, for example.

3 But if you go to the type of a detailed
4 reprocessing, such as industry would like us to do and
5 which they mentioned at the last public meeting, then
6 it becomes a little bit more difficult because, then,
7 you go down and you start separating on the cesiums,
8 the strontiums, and the lanthanides, TRUs, and things
9 like that. It gets a little bit more difficult.

10 We don't have a good feeling of what the
11 specific radiological components would be if we
12 processed waste from, say, an 850-megaton-per-year
13 facility using high burnup of, say, 60,000-megawatt
14 days per metric ton.

15 When it comes to the pyrochemical
16 processing, there's a little bit more in there because
17 we do have a fairly good idea of the two streams that
18 come out. You know, one is going to be going to ion
19 exchange, and it is going to be solidified, and the
20 other one is going to go to a metallic. We have a
21 little bit of understanding of that.

22 But it basically comes down to what
23 stream, what specific radionuclides go into that, and
24 then, of course, the regulations and the guidelines
25 that go into it to ensure that we have the stability

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1 and things like that.

2 MR. CAMERON: Go ahead, Mike.

3 MR. LEE: If you look at existing Part 61,
4 that regulation was predicated on some assumptions
5 regarding waste streams at the time, which was the
6 early eighties, late seventies, early eighties. The
7 staff looked at 36 waste streams, and from that
8 evaluation, they identified 24 radionuclides that
9 would be of interest. And 12 of the 24 radionuclides
10 actually form the foundation for the waste
11 classification tables and the system that Part 61 is
12 developed under. There's a Class A, B, and C, and
13 then radionuclide C waste.

14 In this case, though, like Phil said, you
15 are really not sure what kind of waste stream is going
16 to -- it's all technology-specific. So one of the
17 challenges to the staff is to try to hypothesize, you
18 know, given this variety or this collection of
19 technologies, you can hypothesize a series of waste
20 streams. Then you can set up a regulatory definition
21 that is bounding. There's a lot of ways to deal with
22 that.

23 MR. CAMERON: So you need to know the
24 waste streams, but you also need to figure out, what
25 are the characteristics of those streams that would

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1 put them into one way of disposal versus another way
2 of disposal?

3 Phil, I'm going to come back to you. Keep
4 your tent up.

5 But let's go to Rod and Jim and John.
6 Rod, you may be able to put a finer point on all of
7 this from an industry point of view.

8 MR. McCULLUM: Yes, again, in the vein of
9 technology-neutrality, I guess I want to try to put a
10 challenge to the staff here.

11 Going back to risk-informed, performance-
12 based, starting with understanding of the hazard, and
13 I think you had one bullet up there that said the
14 scheme we have now is largely origin-based as opposed
15 to hazard-based.

16 If you go back to that, and the challenge
17 I want to try to bring forward here is, is it
18 possible, without having to know the specifics of the
19 process stream or the specific technology, to develop
20 something useful here that we can provide assurances
21 of public health and safety?

22 Taking it back to the hazard -- and,
23 remember, you're looking at understanding hazards and
24 understanding what must come between the hazards and
25 the people and the environment you're trying to

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1 protect. That's really the nature of what we're
2 trying to do here.

3 In this case, the thing that's coming
4 between the people and the environment and the hazard
5 is some form of disposal, be it a geologic repository
6 or a Part 61 type of facility.

7 So, if you start with understanding of the
8 hazard, is it possible that the staff might be able to
9 define a hazards-based approach that would prescribe a
10 methodology for classifying waste that an applicant
11 could then use to classify the waste in accordance
12 with that methodology? And thereby, you do not have
13 to yourself wait for the knowledge of the process
14 stream.

15 I guess I would like some feedback on
16 that.

17 MR. CAMERON: Okay. Thank you, Rod.

18 Jim?

19 DR. BRESEE: I am quite sure the NRC staff
20 is looking hard at the issue of changes away from
21 origin-based. Just to cite the famous example, under
22 current regulations if you did a rather complete
23 separations process and were able to isolate, for
24 example, the uranium stream from all others, there are
25 processes that will allow that. The uranium would be,

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1 which from a risk standpoint a relatively low-risk
2 material for handling, would still be classified as
3 high-level waste under its origin, which is from the
4 particular process parameters.

5 I also wanted to be sure that in the
6 effort to be technology-neutral there are some
7 consistencies which can allow rather specific analysis
8 early on. One doesn't need to wait for the final
9 technology.

10 Virtually all processes, whether they're
11 pyro or aqueous, will need to deal with gaseous wastes
12 and, in particular, with krypton. Krypton will be an
13 issue essentially technology-independent because of
14 its chemistry.

15 So the current krypton regulations, which
16 are based upon a reactor-based economy rather than a
17 separations-based, have the opportunity for
18 considerable improvement. You have the advantage, of
19 course, of a fairly short half-life, an 11-year half-
20 life for krypton-85. So that it becomes much less
21 significant if you're dealing with 50-year-old waste,
22 on the one hand, or short-cooled materials, which has
23 been proposed as a way of handling other problems.

24 A short-cooled, less-than-five-year-cooled
25 process takes advantage of less decay from

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1 plutonium-241, and therefore, reduced hazard
2 associated with americium-241. So there are certain
3 pressures pushing you in the direction of short-cooled
4 processing, but, then, that raises the issue of
5 krypton as a potential hazard.

6 So, along with krypton, you will need ways
7 of dealing with iodine-129, carbon-14, and tritium. I
8 will just leave those as gaseous issues that will
9 require some special analysis.

10 MR. CAMERON: And, Jim, all of these, the
11 krypton, the iodine, the carbon-14, the tritium, those
12 are common to all processes. So the staff knows that,
13 no matter what the process is, they are going to have
14 to address those?

15 DR. BRESEE: Yes, and fortunately, there
16 are some new and rather interesting approaches from
17 the standpoint of actual management of the materials.

18 Those new approaches, metal-organic framework, and so
19 forth, are issues that require a lot of close
20 collaboration between the technology development area
21 and the regulatory area. So we will continue to work
22 closely in that area, too.

23 MR. CAMERON: Okay. Thank you.

24 John?

25 DR. FLACK: Yes, I mean the krypton issue

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1 is a real showstopper. I don't know where EPA is on
2 that right now and whether there's anybody in the room
3 that is from EPA. There is?

4 And has there been any new developments in
5 that area? Because that is a very important area to
6 deal with, as Jim mentioned. And a lot of it may be
7 right now in EPA's ball park.

8 So can you speak to that, anyway, on that?

9 MR. CAMERON: Do you want to speak to
10 that, is the question.

11 (Laughter.)

12 EPA is in the process of developing
13 perhaps changes to 40 CFR 190, but whatever you can
14 say. Thank you.

15 MR. LITTLETON: Brian Littleton with the
16 EPA.

17 Just a brief statement in this sense:
18 that we are looking at the issue, conducting studies
19 and conducting analyses on it, and we hope to come out
20 with, I guess, some sort of direction in the near
21 future. I think that is the quickest way of
22 addressing it.

23 MR. CAMERON: Okay. Thank you, Brian.
24 And we may revisit you again this afternoon when we
25 are talking about environmental factors.

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1 So, when you said krypton is a
2 showstopper, what did you mean by that? It was
3 important or it's a showstopper?

4 DR. FLACK: Well, if the criteria is made
5 such that the technology can't support meeting it, I
6 mean, what do you do? The technology has to be
7 capable of dealing with the issue. If it doesn't,
8 then it's like having a plane that is too heavy to
9 fly, basically. That is the part that we are really
10 trying to come to grips with.

11 But I understand that EPA is looking at
12 this. So I guess it is in the pipeline.

13 The other question I had was, how
14 important the last bullet is, and whether or not the
15 staff is actually looking at that with respect to,
16 say, you know, international experience and the need
17 for this classification.

18 MR. CAMERON: Well, go ahead, Mike.

19 MR. LEE: Yes, thank you. Oh, I didn't
20 see the red.

21 A couple of points. One, gaseous releases
22 are covered under EPA's NESHAPs. So I'm not that
23 familiar with them, but they concern radionuclide or
24 gaseous radionuclide effluents. I am not sure the
25 extent to which krypton is addressed in those. So I

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1 speak to ignorance in that regard.

2 But the point that Rod was making -- I
3 will get to this other bullet in just a second -- is
4 that, under Part 61 right now, you kind of have an
5 implied ceiling on low-level waste. It is 100
6 nanocuries per gram concentration, I believe, and then
7 there is also an intruder, implied intruder dose
8 limit. So, to a certain extent, you have ceilings,
9 kind of a tiered ceiling, if you will, to the
10 classification of the wastes.

11 Interestingly, the effluent from a
12 reprocessing facility is not waste until it is
13 actually on its way to some disposal facility. So one
14 of the issues that is going to have to be addressed I
15 believe in the rule, or at least given some
16 consideration, is possibly a pre-processing step. And
17 that pre-processing step in terms of stability and
18 handling and things like that might be necessary in
19 order to make the waste form, whatever it may be, and
20 whatever concentration it might be acceptable to some
21 disposal facility Waste Acceptance Criteria.

22 DOE facilities, for example, have site-
23 specific Waste Acceptance Criteria, WAC. So you
24 already know in advance what the facility is capable
25 of handling based on some, I don't want to say

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1 performance assessment, but some kind of analysis
2 tells you what the facility can handle, based on a
3 contaminant fate and transport calculation or an
4 intruder dose scenario, or something like that.

5 So, like I said before, depending on what
6 the waste stream is and how it is processed, it is
7 going to be an integral part of the definition of the
8 waste stream and how it is managed in the context of
9 some disposal scenario. So these are the things that
10 the staff have to come to terms with.

11 The last point, I am having a senior
12 moment. The caffeine hasn't kicked in.

13 Oh, yes, I don't want to steal Larry
14 Camper's thunder, who is the Director of FSME, but one
15 of the issues or one of the challenges that the staff
16 has been given by the Commission is to look at how we
17 might risk-inform Part 61 if we were to look at it
18 from a position of tabula rasa, for those Latin
19 students, a clean slate.

20 If we were to go back and redo the low-
21 level waste regulation, how would we go ahead and
22 recraft it, taking into account a more risk-informed,
23 performance-based approach?

24 The International Atomic Energy Agency,
25 IAEA, I believe has a geologic Safety Guide 1. And in

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1 that Safety Guide, they have a table that looks not
2 unlike what you might see if you were looking at a
3 pressure temperature diagram, for those of you that
4 might have a thermodynamics background.

5 But it is broken into areas. High-level
6 waste is one of the areas. They have a de minimis
7 threshold. They have intermediate and low-level
8 wastes, and then they have decay and storage. That
9 certainly is an option that the staff is going to
10 consider as it reports back to the Commission.

11 But it provides a useful framework, I
12 think, for looking at a reprocessing facility and
13 thinking about ways to not only manage the waste, but,
14 also, how they might be classified.

15 MR. CAMERON: Do you need these other
16 rulemakings to be final before you develop this
17 regulation and how it is going to treat waste?

18 MR. LEE: I've got to be careful of how I
19 answer that. I mean this is just --

20 MR. CAMERON: I think people would
21 probably be curious about what the relationship is, I
22 guess is my question.

23 MR. LEE: I would defer to Alex. Do we
24 have a timeline for this?

25 MR. CAMERON: We'll defer to Alex. We'll

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1 go to Alex right here.

2 MR. LEE: No, he just needs to give me a
3 year, and then I'll answer your question, I think.

4 MR. CAMERON: Go ahead, Alex, whatever you
5 wanted to say and whatever you want to answer on this
6 one.

7 MR. LEE: Sure. Okay. I mean I can
8 answer the question. I just need to know what the
9 timeline is because the Commission, the other piece of
10 the information or we've gotten direction we've gotten
11 from the Commission, is that if we were to do a low-
12 level waste revision, that revision isn't to start
13 until fiscal year 2013.

14 So the potential for amending the
15 regulation in the manner I have just described or
16 suggested, which is just one way of doing it, is a
17 little bit down the road.

18 Alex?

19 MR. MURRAY: Yes, I was just going to
20 mention from yesterday's overview presentation, the
21 date for final rule for reprocessing was identified as
22 2015, assuming resources would be available to do the
23 work.

24 MR. LEE: The only friendly amendment I
25 would offer is that currently the Part 61 reg, I'm not

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1 saying that all reprocessing waste is going to be
2 managed in a Part 61 shallow-land burial type of
3 disposal scenario. But the current definition of low-
4 level waste is everything that the waste is not.

5 It's you have high-level waste, which is
6 defined by the Atomic Energy Act, and it's
7 incorporated now by reference in Part 61 with some
8 fine-tuning. You have TRU waste, I mean these other
9 -- if you're going to reshuffle the chairs on the
10 deck, you need a lot of horsepower and a lot of
11 alignment, and I think some help from Congress.

12 So I think, in our own little way, the
13 existing Part 61 regulation with amendments might be a
14 comfortable way of managing this waste stream or these
15 streams.

16 MR. CAMERON: Okay. Thank you.

17 I'm going to go to Ed now, and then come
18 back to Phil and see what he can add to this. Ed?

19 DR. LYMAN: Yes, I would just like to
20 point out, rather than miss the forest for the trees,
21 I just want to back up a little bit and point out
22 that, according to the information that was presented
23 on the slides, that the total volume of waste,
24 including high-level waste, greater-than-Class-C, low-
25 level waste, and processed uranium, would increase by

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1 about a factor of four over the volume of the initial
2 spent fuel.

3 What you are doing is exchanging a problem
4 with disposing spent fuel in a geologic repository we
5 don't have with the problem of disposing of high-level
6 waste in cladding holes in a geologic repository that
7 we don't have, disposing of a significantly increased
8 volume greater-than-Class-C waste in a repository that
9 we don't have to disposing of a significantly greater
10 volume of low-level waste in facilities that we don't
11 really have, and a whole bunch of reprocessed uranium
12 that is going to sit around because there isn't any
13 defined disposal pathway for that material.

14 So, in this context, I would say that it
15 could possibly have an implication for the waste
16 confidence. Frankly, I would think that, if there was
17 a serious push for a reprocessing plant, it would
18 seriously call into question the Commission's ability
19 to say that they have confidence that they are going
20 to be able to dispose of all these multiple waste
21 streams.

22 MR. CAMERON: Okay. Thank you. It is
23 good to get back to the forest.

24 Phil?

25 MR. REED: I just wanted to make two

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1 points. The first point I would like to make is, if
2 you remember Alex's presentation where he talked about
3 a couple of regulations that were published back in
4 the 1970s but were subsequently rescinded, well, in
5 the current Appendix F to Part 50, that's the
6 reprocessing regulation, there was a forerunner to
7 that regulation, which was Appendix D.

8 Now Appendix D in the last paragraph, I
9 guess the second-to-last paragraph, talked about hull
10 disposal. But the last paragraph essentially talked
11 about what we would consider today to be low-level
12 waste disposal.

13 And that regulation provided specifics.
14 It talked about ion exchange resins. It talked about
15 DAW-type waste. It talked about the tools, and
16 essentially large volumes that have essentially small
17 amounts of radioactivity, which would supposedly be
18 buried at that time in 20.302, which today was the
19 forerunner of 10 CFR Part 61, but that was removed.

20 I think by that removal, that made life a
21 little bit more difficult for us. If that regulation
22 or that subsection had remained today, I think that
23 would have clarified a lot of the issues regarding
24 low-level waste, and particularly WIR. And as a
25 result of us not having that, we are having to

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1 struggle to redefine it.

2 The second point I wanted to make was what
3 Mike had alluded to with regards to 10 CFR Part 61. I
4 think it is becoming clear to the staff after we are
5 doing a few analyses, and admittedly we have to do a
6 lot more, that there may be some radionuclides that
7 are in the reprocessing streams which could
8 conceivably end up in low-level waste that are of
9 large volumes and small amounts of activities.

10 However, Part 61 does not cover all the
11 radionuclides. So, essentially, if you are disposing
12 radionuclides in Part 61 that may be considered a low-
13 level waste, it would essentially go into Class A.
14 And Class A means that you can put as much as possible
15 in there.

16 Well, we would like to refine that
17 analysis, and if there are radionuclides that are
18 going into the low-level waste site on Class A, we
19 would like to make sure that maybe they should be
20 Class B or C. They should be stabilized as opposed to
21 just a priori putting them under Class A.

22 The other thing is that it does look as if
23 an operating reprocessing plant would generate similar
24 radionuclides that are already in Tables 1 and 2 for
25 Part 61. Particularly, they would then be classified

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1 as low-level waste.

2 It covers the activated metals. Even the
3 transuranics are listed to be disposed in Class A.
4 But a number of radionuclides that we already see over
5 there could easily be disposed of today under Part 61.

6 MR. CAMERON: Is the Appendix D that you
7 mentioned, you said it would solve a lot of problems.

8 Is there some thought that the new rulemaking would
9 resurrect some of the aspects of Appendix D?

10 MR. REED: I don't think we have
11 approached it that far. We are just in the initial
12 part of our analysis right now. We have just made the
13 observation. We have not made any recommendations or
14 discussions yet.

15 MR. CAMERON: Okay. Arjun? Use your
16 microphone, please.

17 DR. MAKHIJANI: Just a factual question
18 for Mike before I make my comment. I don't see
19 decommissioning waste in there in your streams. Am I
20 right or is it buried in there somewhere that I have
21 not seen?

22 MR. LEE: I am going to pass the ball to
23 Alex because Alex put this together.

24 MR. MURRAY: Decommissioning waste is not
25 on that slide. That is strictly operational.

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1 DR. MAKHIJANI: Okay. Because I strongly
2 recommend that you have a decommissioning waste stream
3 there. First of all, you have got to have financial
4 guarantees for your decommissioning waste as part of
5 your licensing process.

6 I think decommissioning a large,
7 commercial reprocessing plant, which has not happened
8 to my knowledge yet, is going to be a major headache.

9 The only experience we have with that is at West
10 Valley, which was, I would say, more than a major
11 headache, a \$32 million plant that cost what, \$5
12 billion to decommission, something? That ratio might
13 change over time, one hopes, with some learning, but
14 you need to add the decommissioning waste.

15 Now Part 61, my favorite part of the NRC
16 lexicon here, in my reading, actually, of Part 61, if
17 you don't have radionuclides in Table 1 or Table 2, if
18 it was covered in the EIS, then it could be Class A.
19 But this idea that you can stuff everything in the
20 (a)(6), 61.55.(a)(6), and say it's Class A is not
21 right because it needs to be read as English. It may
22 be a mistake, given lawyers' interpretation, and I'm
23 not a lawyer. I was told that it was a mistake to
24 read it as English.

25 If it has radionuclides that are in Table

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1 or Table 2 and radionuclides that are not in Table 1
or Table 2, then 10 CFR 61 is actually pretty sloppily
written. In my reading of the rule, a situation like
that, would be typical for waste coming from a
reprocessing plant, could not be classified as Class A
waste under the rule.

The rule is silent on whether it could be
classified as Class B or Class C waste because there
is no catchall category for Class B or Class C waste.

In fact, under the rule, a mixture of radionuclides
that are in Tables 1 and 2 and that are not in Tables
1 and 2 is currently not classified, in my opinion.

I revisited this in light of all the
controversy that happened after our October Depleted
Uranium Workshop, which is a group that Mr. Camper is
leading, because depleted uranium is over contaminated
with other materials that were shipped from DOE to
Utah in a subsequent period, and I got involved in
that.

I think if you are going to rewrite the
low-level waste rule, it needs to be done before you
have the complications of a reprocessing plant,
keeping in mind the complications of a reprocessing
plant.

For example, if you look at that Table --

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1 I'm sorry, I am going to hold you for a little while
2 on this because I have spent a good bit of time
3 teasing out these questions. I haven't written any
4 official history, but I have certainly written non-
5 government reviews of it more than once.

6 If you look at the reprocessed uranium
7 column, this is what the Department of Energy was
8 trying to escape from. And I was told, actually, that
9 the Savannah River Site doesn't do reprocessing
10 because it is separating target materials for
11 plutonium production and saying, okay, in my
12 definition, this is reprocessing, what goes on in
13 F-Canyon at Savannah River Site. I was officially
14 told this.

15 Now if you take that reprocessed uranium
16 today, which is not classified as a waste by DOE, most
17 of it will become a waste, even if you use it, because
18 it will have to be re-enriched, and 85, 87 percent of
19 it will wind up as contaminated depleted uranium.

20 You are trying to deal with it in that
21 other, you know, stream of regulatory reform, which
22 Mr. Camper is leading, but they haven't even begun to
23 define contaminated depleted uranium and where it
24 fits.

25 I think in the context of waste, I would

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1 seriously disagree with what -- I can't see the name
2 of the gentleman from the DOE. While uranium may be
3 regarded as not so much of a problem to handle, it is
4 a problem material as a waste because of its long
5 half-life and the buildup of its decay products.

6 And that is why you get into all of the
7 headaches with large amounts of depleted uranium from
8 enrichment plants. You are going to get into the same
9 headaches with large amounts of depleted uranium or
10 reprocessed uranium for direct disposal.

11 I think you really need to settle -- and
12 there will be some common questions -- you really need
13 to settle these questions before. I also think this
14 whole idea that it isn't waste until it's on its way
15 to a disposal facility is a legal artifact that has
16 nothing to do with the protection of the public
17 health.

18 I mean, currently, if you look at the
19 discharges from La Hague or Sellafield, if you take
20 that discharge pipe and put the stuff in a barrel, and
21 take the barrel on a ship and throw it overboard, it
22 would be illegal under the London Dumping Convention.

23 But because it comes out of the pipe and is called a
24 discharge, and it isn't a waste until it's on its way
25 to a disposal -- well, a pipe is a disposal facility.

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1 That is how that liquid waste is disposed of.

2 And you cannot simply say that effluents
3 are taken care of by existing rules when reactors have
4 three orders of magnitude less emissions than
5 reprocessing plants. You've got three orders of
6 magnitude more, four orders of magnitude more
7 emissions to liquid waste streams from a reprocessing
8 plant as a reactor, and you can't pretend that it is
9 simply not a waste just because it comes out of the
10 end of a discharge pipe.

11 I think we have to get rid of the legal
12 artifacts and actually focus on the health and
13 environmental issues. And there are just a vast
14 number of them.

15 I said in the depleted uranium thing, and
16 the Chairman of the NRC had said that in regard to
17 depleted uranium: you've got to revisit the rule and
18 not just stuff under some modification of 10 CFR
19 61.86. I would strongly advise against that. I think
20 any suggestion that you could hide reprocessing waste
21 under legal artifacts of 10 CFR 61.55 would be really
22 wrong.

23 First of all, 10 CFR 61.55 doesn't cover
24 many of the waste streams that would come out of a
25 reprocessing plant, in my opinion at least.

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1 MR. CAMERON: Okay, thank you. Thank you,
2 Arjun, for all of that.

3 Rod, you have heard comments around the
4 table.

5 And by the way, it is Jim Bresee from the
6 Department of Energy down here.

7 DR. MAKHIJANI: I couldn't see your name.

8 MR. CAMERON: There's an introduction
9 going on, for the record, exchange of business cards.

10 (Laughter.)

11 Okay, great. Thank you.

12 MR. McCULLUM: I'm glad this figure got
13 called up. I will thank Ed for bringing that figure
14 back up, although I will not agree with him in this
15 case.

16 This figure is, to me, an outstanding
17 example as to why technology-neutrality is important
18 here and why it is important not to regulate based on
19 knowledge of a given waste stream from a given
20 technology.

21 That is a figure that depicts one
22 particular technology at one particular point in time.

23 I notice there it says that this was May 16th, 2007.

24 And it also depicts that technology based
25 on how much waste you get out for a given amount of

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1 spent fuel that you start with.

2 The first thing, I want to talk about time
3 and I want to talk about looking at this as a per-
4 energy basis, as opposed to a per-metric-ton-of-spent-
5 fuel-you-start-with basis.

6 I have heard several presentations from
7 the company that does PUREX over in France about how
8 they have made improvements in their waste stream in
9 recent years, since 2007. They are constantly
10 refining and improving this.

11 I have heard presentations from that same
12 company about evolutionary technologies, as to how the
13 facility they might build in the United States would
14 be improved yet again.

15 And there's a gentleman from GE sitting
16 down there at the end of the table looking at this
17 figure who is probably thinking of what his own waste
18 stream looks like, and might at some point make the
19 case that he has an even more improved waste stream in
20 his facility.

21 So to key a regulation on knowledge of a
22 given waste stream kind of takes away one of the
23 purposes of the regulation, which is to assure safety
24 and to promote safety, in that by putting a
25 methodology that would encourage the classification of

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1 waste, WIR, low-level waste, high-level waste, that
2 would drive continuous improvement in the waste
3 streams, that would seem to be in the best public
4 safety interest of getting us to where we want to go
5 here and helping us make responsible decisions. So,
6 you know, I would not look at this as a snapshot in
7 time.

8 Another thing, when you make the argument
9 that, well, this proves that there is more waste
10 coming out than going in, remember, this is per a
11 certain amount of spent fuel to start with. You're
12 also getting out a certain amount of MOX from which
13 you will derive more energy. Different processes get
14 things out other than MOX and in different quantities
15 and drive more energy.

16 Again, if you were to prescribe a
17 methodology for categorizing waste that would
18 encourage the utilization of it -- oops, my figure
19 just went away. I mean you look for terawatt hour of
20 electricity; you see a different story. We are not
21 having to generate as much spent fuel because we are
22 using some of the energy that is already in the other
23 spent fuel.

24 So I would just discourage using -- this
25 is the reason why I would discourage basing the waste

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1 classification scheme of the regulation. And I'm
2 agreeing with some of the stuff I heard around the
3 table. There are needs for improvements. There are
4 probably things in Part 61 that aren't addressed, and
5 so on and so forth.

6 And this is an opportunity. We said at
7 the very beginning here that we may be looking at
8 parts of the regulation other than Part 7x, or
9 whatever we're looking at.

10 I just want to close before I get too
11 long-winded here. Now that I have discussed this, if
12 we could move to that last slide, the one that posed
13 the questions?

14 Every other discussion we have had we kind
15 of just discuss and we don't really go down the
16 points, but those are some excellent points here. And
17 it gets me to something Arjun just said about taking
18 on this notion of it's not waste until it leaves the
19 disposal facility.

20 There is something in there, onsite
21 storage to allow decay. The reason it is not waste
22 until -- excuse me -- it leaves the recycling, is on
23 the way to the disposal facility, is because the very
24 nature of this material is radioactive. That means it
25 has radioactive decay. That means it becomes less

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1 radioactive with time.

2 One aspect of recycling could be to keep
3 it in the facility until some isotopes have decayed,
4 so now they don't have to become waste. So you have
5 an aspect of this regulation here, and this hints at
6 that, where you're talking about onsite storage of
7 four things in the first part.

8 We would encourage this regulation to very
9 much address when it's integral to the process to
10 store, that's part of your facility that needs to be
11 addressed in this regulation. Then classify what
12 comes out the back end of that in a way that is
13 technology-neutral.

14 But certainly, integral to a recycling
15 facility, decayed storage could very well be part of
16 it, and the regulations should provide for that.

17 Thanks.

18 MR. CAMERON: Mike?

19 MR. LEE: Three points. One, the earlier
20 comment regarding the waste acceptance or waste
21 confidence decision is in reference to nuclear power
22 reactors. John Garrick's name has been used over the
23 last day or so, and he was always in favor of a waste
24 confidence evaluation in the context of the full fuel
25 cycle.

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1 So one thing that this rule, if and when
2 it goes out for public comment, could be a request for
3 comments on, is it appropriate to ask to implement
4 some kind of provision, if you will, in this regard,
5 making it incumbent on the Commission or the staff or
6 somebody at the NRC? I think that is something that
7 the staff should consider as part of its deliberations
8 in the future.

9 The second thing is reference was made to
10 depleted uranium and the Waste Classification Tables
11 and how the regulation currently reads. Basically, if
12 you are not one of the 12 radionuclides listed under
13 Table 1 or Table 2 of 61.55, you are default Class A.

14 That is a decision that came out of the
15 LES adjudication, and the Commission voted on it. So
16 it is not the staff's decision; it's the Commission's
17 decision. So there are certainly many ways to
18 interpret the regulation independent of the LES
19 decisionmaking. But, as of today, the law of the
20 land, if you will, is the LES decisionmaking. So,
21 until that changes, it is what it is.

22 The staff is currently involved in a
23 limited rulemaking to Part 61 to impose an explicit
24 performance assessment requirement that would be used
25 to evaluate whether DU or any other waste stream

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1 that's not covered under Part 61 explicitly might be
2 acceptable for disposal in a shallow-land disposal
3 scenario. It is not saying it can be.

4 The rule, which is going to go out for
5 comment, I think, in about a year, asks to be used to
6 evaluate whether or not DU and other, for lack of a
7 better word, unique waste streams might be suitable
8 for disposal under a Part 61 type of paradigm.

9 The other comment, and I tried to allude
10 to this earlier, is that Part 61 is predicated on 24
11 radionuclides, based on 36 waste streams, and the
12 regulatory arrangement, if you will, says these
13 radionuclides under these disposal configurations can
14 be managed safely in a shallow-land burial
15 environment.

16 But the notion that anything that is not
17 high-level waste or not spent fuel or not greater-
18 than-Class-C can be disposed of in that manner I don't
19 believe is appropriate. There are other alternatives
20 to shallow-land burial. There's enhanced engineering
21 facilities. There could be intermediate depth
22 disposal.

23 If you go back and read the statement
24 considerations for Part 61 and the public comments on
25 both the draft and the final EIS, the staff and the

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1 Commission acknowledged that there are other ways of
2 managing, ways that could be low-level waste, but not
3 consistent with the waste classification scheme under
4 Part 61.

5 So, I just wanted to get that out on the
6 table. It probably takes more time to explain it, but
7 there are other low-level wastes out there other than
8 Part 61 characteristic low-level wastes, if you follow
9 my meaning.

10 MR. CAMERON: Okay.

11 MR. LEE: What the longer-term rulemaking
12 is intended to evaluate is, in addition to shallow-
13 land burial, are there other waste streams out there
14 in the foreseeable future that might be amenable to
15 disposition in other than a shallow-land burial
16 scenario?

17 MR. CAMERON: Okay. Thank you. I think
18 you piqued Arjun's interest.

19 Arjun?

20 DR. MAKHIJANI: A couple of things.

21 I was referring to the DOE waste that was
22 sent to Utah. It was not covered by the NRC LES
23 license because the NRC LES license proceeding covered
24 depleted uranium from natural uranium feed. It did
25 not cover contaminated depleted uranium.

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1 That is depleted uranium that also
2 contained radionuclides in Table 1 and/or Table 2.
3 That has not been addressed explicitly at least,
4 certainly not in the LES proceeding. I was a part of
5 that for the interveners.

6 Secondly, I think my understanding of the
7 LES proceeding is not the same as yours. The NRC did
8 say it was low-level waste, and we have acknowledged
9 that.

10 However, in regard to Class A waste, the
11 NRC said two quite different things. It said, it
12 acknowledged that, when it's not there, when it's not
13 specified in Tables 1 and 2, it is Class A waste. But
14 the NRC also explicitly acknowledged that large
15 amounts of depleted uranium from enrichment plants
16 were not covered under 10 CFR 61 and directed the
17 staff to engage in a special rulemaking for large
18 amounts of depleted uranium.

19 So it is completely wrong for the NRC to
20 insist, subsequent to the LES decision, that somehow
21 large amounts of depleted uranium are covered under 10
22 CFR 61 as Class A waste. It is completely wrong.

23 And in fact, the whole rulemaking and the
24 vote of the NRC Commission, to which the present
25 Chairman dissented, to change 10 CFR 61, however you

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1 want to characterize that change, recognizes that
2 large amounts of depleted uranium are not covered
3 under the existing rule. Now whether they would be
4 classified as Class A, ultimately, or not is a
5 different matter.

6 But to take a stand currently that large
7 amounts of depleted uranium were classified under the
8 LES process is simply factually incorrect, and I would
9 like a comment on that, just for the record, so it is
10 at least straight as to what the NRC said, as
11 represented by the NRC staff in this room, is not
12 misrepresenting the NRC LES decision.

13 Thank you.

14 MR. LEE: I'm the wrong guy to go to.
15 First of all, I'm not the right guy to go to on this
16 particular subject in this level of detail.

17 DR. MAKHIJANI: But it was your
18 representation about what the NRC said in the LES. So
19 maybe you should withdraw that representation.

20 MR. LEE: All I said --

21 MR. CAMERON: I think that perhaps this
22 has been ventilated enough at this point. What you're
23 trying to say, Mike, is that maybe you are not the
24 staff person who has the best knowledge of this.

25 MR. LEE: Well, the staff has underway a

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1 rulemaking, consistent with Commission direction,
2 right now to introduce a performance assessment
3 requirement to Part 61. That performance assessment
4 requirement would be used to, among other things,
5 establish a baseline requirement for all currently-
6 operating low-level waste disposal facilities.

7 In the matter of the Clive facility, the
8 imposition of that requirement I believe would be used
9 to evaluate whether or not the Clive facility could
10 receive large quantities of depleted uranium for
11 disposal under Part 61. That's the staff's efforts
12 right now. That's what we're doing.

13 DR. MAKHIJANI: This is very important and
14 germane to what we are talking about. Because at
15 least my participation in this process, the reason I'm
16 exercising it, my participation on this process is
17 conditioned on the idea that we should respect the
18 facts.

19 The facts are that the NRC did not say
20 that large amounts of depleted uranium from the LES
21 plant would be Class waste.

22 The second fact is that the NRC has not
23 yet formally started a rulemaking process. There has
24 been a technical paper and a direction from the NRC
25 Commission to pursue something.

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1 You had a workshop in October here. I
2 participated in that workshop. All of the experts
3 around the table -- in fact, the author of the
4 technical paper himself said it was silliness, and
5 "silliness", if you remember, was a word that was used
6 by the author of the paper, to do a million-year dose
7 assessment from shallow-land burial.

8 The NRC's invited expert from Notre Dame,
9 I believe it was, Dr. Burns, agreed with that. We all
10 agreed with that.

11 My conclusion from that outcome is the NRC
12 should go back to the drawing board and redo that
13 whole process. In any case, there has been no notice
14 of rulemaking in regard to that. There's been no EIS.
15 There's been no environmental assessment. So I don't
16 see how you can represent that there's a rulemaking
17 going on.

18 MR. LEE: Well, there is a technical basis
19 currently undergoing review by the Rulemaking Division
20 within the NRC to implement a performance assessment
21 requirement. So that process is underway.

22 In approximately a year, that technical
23 basis or the draft rule will be made available for
24 public comment.

25 MR. CAMERON: So it all depends on how you

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1 define where a rulemaking starts.

2 MR. LEE: Yes.

3 MR. CAMERON: But I think that it's
4 important that we had Arjun, one of our participants,
5 on the record, on the transcript, stating his view on
6 what the state of affairs are in regard to depleted
7 uranium, and that he disagreed with your
8 characterization.

9 MR. LEE: Sure. That's fine.

10 MR. CAMERON: Okay. Thank you, Arjun.
11 Thank you, Mike.

12 Ed, do you want to weigh-in on this issue
13 or do you have another one?

14 DR. LYMAN: No, I had another one.

15 MR. CAMERON: Okay.

16 DR. LYMAN: Just getting back to what Rod
17 said, putting aside the question of what the
18 appropriate metric is to account for the relative
19 waste generation of reprocessing once through, I would
20 like to say that, if you are going to wait for AREVA
21 to come up with improved waste management parameters
22 compared to the slide we saw before, I have the
23 presentation from September of 2009 that gives the
24 waste volumes for recycling, the AREVA presentation.

25 According to those numbers, there would be

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1 about 50 percent greater generation of high-level
2 waste and cladding hole waste than was on that slide.

3 So you are probably going to have to wait a while
4 before you see a significant improvement.

5 MR. CAMERON: Sven?

6 DR. BADER: Let me emphasize that the
7 waste streams that you see up there were probably one
8 sequence or one scenario. The benefit of the PUREX
9 process is you can tailor it to optimize your waste
10 stream, and I'll give you an example.

11 In France, we don't have category A, B, C
12 low-level waste. So the objective there is to reduce,
13 minimize waste, low-level waste that they produce at a
14 facility. Whereas, when we came over here, they
15 didn't take that into consideration, and all those
16 waste streams that you are looking probably got higher
17 classifications, maybe greater-than-Class-C, because
18 they are concentrated.

19 So we are in the process of going back and
20 looking at this. We have tasks in hand trying to
21 tailor another facility that will meet the U.S.
22 regulations, provided they don't change.

23 But, again, the problem is this regulatory
24 stability keeps killing us. So we wait and try to
25 optimize it. So what you get a lot of times are dated

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1 numbers, numbers and values that were designed for
2 meeting certain regulations.

3 Another issue is krypton-85. You said it
4 is a showstopper. It is actually not a showstopper,
5 if you recycle old fuel. We have got plenty of old
6 fuel in this country.

7 So we can tailor this process to meet
8 existing regulations. And you know, there's clearly
9 going to be balances. Activity in equals activity out
10 minus decay.

11 So maybe the volume increased a little
12 bit, but the other point about volume is some of these
13 waste forms are a lot more robust when they come out
14 of our facility. You know, the borosilicate glass
15 that this high-level waste is in I would say is
16 probably a lot more robust than spent fuel that has
17 been sitting around for 50 or more years.

18 The other points, I have been sitting here
19 trying patiently not to say anything, but, you know,
20 the disposal path out at La Hague or the pipe at La
21 Hague, we clearly meet regulations. We're not piping
22 out stuff to contaminate the world. We are meeting
23 regulations, safety standards.

24 And, then, I guess this goes back to what
25 Rod was saying, that it would be nice to have

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1 regulations that are based on safety and hazards as
2 opposed to origin.

3 And then, the last point I would like to
4 point out for the PUREX process that we have in
5 France, La Hague, is that we have a fairly integrated
6 waste disposal path for all the waste there. The
7 process in France understands where our disposal is
8 going to be. So we form these wastes to meet those
9 disposal criteria.

10 Over here, it is kind of, with Yucca
11 Mountain in the current state that it is at, we don't
12 know how to optimize the waste now. You know, do you
13 try to minimize the amount of heat-producing elements
14 in there or do you put something together that's more
15 suitable for salt? These are the types of things that
16 you would have to be aware of when we're talking about
17 a PUREX process.

18 On that, I'll put a period.

19 MR. CAMERON: Okay, thank you. Thank you
20 for those clarifications, Sven.

21 Rod, do you want to say something?

22 MR. McCULLUM: Yes, I just want to
23 emphasize the importance of one thing that Sven said
24 there, that they are working on trying to tailor their
25 waste stream. You know, the goal here is to achieve

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1 benefits of recycling.

2 And there are two potential benefits of
3 recycling. One is you get more energy out of the same
4 amount of material that you mine. The other is that
5 you get an improved waste form. And there are
6 different stories out there as to what an improved
7 waste form is.

8 It is impossible, though, to really figure
9 out how to do that if you don't know what the
10 regulatory framework is, and if the regulatory
11 framework is not technology-neutral.

12 This goes back to the challenge I put to
13 NRC, and I will admit it is a hard challenge. I will
14 admit I don't have the answer myself.

15 But it is to come up with a regulation
16 that provides the classification methodology which
17 will support the goal we want to achieve here, which
18 is you want the best possible streams. You want Sven
19 to be able to tailor a waste stream that makes sense,
20 that addresses the hazards, that allows us to move
21 forward with a better disposition path.

22 So there's a lot to think about here, but
23 I think there are ways to do it. We would encourage,
24 I think, additional dialog in this area because it is
25 a very important aspect of the regulation.

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1 MR. CAMERON: Okay. Thanks, Rod.

2 Ed, do you want to say anything in regard
3 to Sven and Rod?

4 DR. LYMAN: Yes, I think, no matter how
5 you tailor it, the total waste volume coming in for
6 reprocessing is going to be significantly increased
7 compared to direct disposal. And the fact is that
8 AREVA is going around making these representations on
9 that point to the Blue Ribbon Commission and Congress
10 and everyone else, and the record has to be clear on
11 that.

12 With regard to borosilicate glass versus
13 spent fuel, I don't think there's any evidence from
14 leach tests that it retains fission products any
15 better than spent fuel does.

16 MR. CAMERON: Anything else? Feel free.
17 Okay.

18 MR. McCULLUM: Chip, I apologize; I'm
19 breaking convention here a little bit, but I did put
20 my card up.

21 I just want to say for the record that
22 industry does not agree that it is inevitable that
23 recycling will increase waste volumes, and also, that
24 waste volume is not the only criteria here. The
25 amount of radiation, the amount of heat that is in the

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1 waste is also important.

2 MR. CAMERON: Okay.

3 MR. McCULLUM: So we do not agree with
4 that.

5 MR. CAMERON: All right.

6 And, Alex?

7 MR. MURRAY: I greatly appreciate that,
8 Chip. I have been patient.

9 I just wanted to make perhaps three
10 points.

11 I have heard the discussion here. I have
12 heard different waste forms mentioned, and so forth,
13 different characteristics.

14 If I put on just my general
15 engineer's/scientist's hat, there seems to be a
16 gradient in the risk, or should I say hazards, if you
17 will, of the different waste forms. There may even be
18 some dependence on process or process efficiencies; I
19 don't know.

20 But it would seem that something that is
21 more uranium-based, reprocessed uranium, what have
22 you, would seem to have a lower hazard than something
23 that contains a waste or potential waste stream that
24 contains transuranics or contains vitrified high-level
25 waste. There seems to be a difference in the hazards.

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1 And I encourage the members at the table
2 to discuss that and see if there can be some sort of
3 common ground. Yes, we could say uranium is
4 radioactive. That's right, it heats the whole planet
5 up. Okay, the planet is six times 10 to the 24th
6 kilograms. Okay? So there's a lot of uranium. It's
7 naturally radioactive.

8 But there seems, again, to be some
9 miscommunication here on what these relative hazards
10 might be and how do we, as an informed community at
11 the table and an informed public, how do we address
12 the apparent reality of different hazards from
13 different waste streams?

14 The second thing which I have heard kicked
15 around here, and I would just like to make it more
16 explicit, is there are different waste rulemaking
17 developments going on. There was an Appendix D for
18 reprocessing waste in a previous, earlier version of
19 Part 50.

20 A question I throw out to the panel here
21 and to the public here is, if there are wastes
22 specific to reprocessing, how they should be managed
23 and potentially disposed of. Should that be in a
24 rulemaking on reprocessing and recycling or should it
25 be part of a rulemaking on one of the various NRC

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1 regulations relating to waste? Okay?

2 One last aspect, we're going to discuss,
3 hopefully, if time permits, emissions and effluents
4 later on today. High emissions and effluents waste,
5 too many -- you know, I'm an Englishman, and American
6 is being spoken in this room, not English. Okay?

7 But I would have to throw the question out
8 for the people who are assembled here, both on the
9 panel and the public in the room, are doses low?
10 Whether from actual or proposed commercial
11 reprocessing plants, are the doses low, to members of
12 the public from effluents, emissions, and what have
13 you?

14 Because, ultimately, the regulation dose
15 is a measure of risk. So I ask that question to
16 everybody. Are the doses low? Are they low enough,
17 if they are low? I don't know.

18 Thank you.

19 MR. CAMERON: Okay. I think we can
20 address that when we get to the environmental part.

21 We need to break for lunch now because
22 they are setting up a special buffet, although it's
23 not free, but it's special.

24 But I would like to come back, we have
25 time after we come from lunch, 1:15, to address the

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1 waste issue and some more details before we go to
2 security.

3 But perhaps we could address Alex's point
4 about, can we find any common ground on the
5 representative hazards from different waste streams?
6 I don't know if we can do that.

7 And also, I would like to go back to Bob's
8 point about he said the methodology for characterizing
9 waste would encourage minimization. I wondered if you
10 could just tell us, when we come back, what provisions
11 is the industry thinking about in terms of how the
12 rule should address waste? I think it might be useful
13 for everybody to hear that, and then we can discuss
14 that.

15 So why don't we break? And we will come
16 back at 1:15, talk some more about waste, go to the
17 public, hear their views, and take it from there.

18 (Whereupon, the foregoing matter went off
19 the record for lunch at 12:03 p.m. and went back on
20 the record at 1:24 p.m.)

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

1:24 p.m.

MR. CAMERON: Okay. We're going to try to wrap up the waste discussion.

There were two issues that I mentioned before we left, and maybe they can connect up. But I thought it might be useful to get into some specifics and use what the industry has developed as a possible proposal for how you would treat waste, reprocessing waste, in the rulemaking.

Maybe that can segue into these representative hazards from different waste streams that Alex brought up, if, Rod, at the end of describing the industry framework, if you could just say, "And here's how the industry framework would address that particular issue," to the extent that we understand what Alex is getting at there.

MR. McCULLUM: Yes, and I will start out by saying I thought that was an excellent point for Alex to raise, and I'm glad you wrote it down. I think the industry position is really the flip side of the question, if you will, if you turn the question into an answer.

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1 Succinctly, what industry would like to
2 see here in a regulatory context is we would like to
3 see a hazards-based methodology for waste
4 classification be developed. It needs to be
5 technology-neutral. It needs to include a category of
6 waste incidental to the reprocessing, consistent with
7 the way this term has been applied with some of the
8 DOE high-level tank waste, and NRC has been involved
9 in that.

10 We had in the proposal that industry sent
11 to NRC what we call Part 7x. We had outlined just
12 that position to be developed in Part 7x. This
13 discussion and other things that have occurred since
14 then, I think this discussion is particularly helpful
15 in this regard.

16 We believe that it is really broader than
17 just the new recycling regulation, that, indeed, in
18 addition to putting out a risk-informed, performance-
19 based -- and I haven't said that in almost an hour, so
20 I had to get that out (laughter) -- a risk-informed,
21 performance-based --

22 MR. CAMERON: We'll remind if we don't
23 hear it every minute or so.

24 MR. McCULLUM: -- recycling regulation, in
25 companionship with that, you have to risk-inform Part

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1 61 and assure that Part 61 is comprehensive to address
2 the waste forms of the future. And I think there has
3 been a lot of talk about limitations in the number of
4 radioisotopes.

5 Industry did submit a White Paper in
6 October 2009 entitled, "High-Level Waste Insights" to
7 the staff on this topic. One of the co-authors of
8 that paper, Jim Lieberman, is in the audience. So, if
9 more detailed discussion is warranted, I would defer
10 to him. I was not one of the co-authors of that
11 paper. So I can't get into any more detail.

12 But, again, it goes back to -- and I'm
13 glad Alex raised the question because it's about,
14 remember, what we're trying to do here is establish a
15 standard that protects public health, safety, the
16 environment, and workers. We are trying to understand
17 the hazards and assure that we require the appropriate
18 things to be placed between the hazard and the workers
19 and the public, and all that.

20 And by coming up with a hazards-based
21 classification scheme, and by including WIR as one of
22 the classifications, that enables us to do that. I
23 think if we succeed in doing that both in this
24 regulation and assuring that Part 61 is equally risk-
25 informed and equally comprehensive, then we will go

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1 about accomplishing what I think the question Alex was
2 leading to, and he can correct me if I'm wrong, as
3 well as the overarching point that we're trying to get
4 across here is what you want is a regulatory structure
5 that encourages improvements in waste management, that
6 encourages a safer, safest, whatever, system.

7 So, you know, as we are making decisions
8 about how, when, where, and pursuing recycling
9 technologies, having that in place in advance so we
10 can make informed decisions and, as Sven said, tailor
11 our waste streams to do the job and meet that
12 regulation, again, it's a big challenge for the staff.

13 But I have heard a lot today that indicates that they
14 certainly recognize this challenge. And I look around
15 the room and it's a crew I think should be up to it.

16 MR. CAMERON: Okay, and we had this
17 discussion somewhat today about the waste
18 classification in Part 61 and (a), (b), and (d), et
19 cetera, et cetera.

20 How does 7x deal with that problem? I
21 take it that the methodology for classifying waste
22 streams is that some would be high-level waste, store
23 onsite if no repository or away from facility storage,
24 so to speak. Some would be WIR, and some would be
25 low-level waste.

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1 MR. McCULLUM: Right.

2 MR. CAMERON: Do you get into what
3 category, what classes of low-level waste it would be
4 or you just followed an existing Part 61
5 classification?

6 MR. McCULLUM: I think at this point we
7 just followed existing classification. I think we are
8 looking to go further, and I think this discussion has
9 advanced that.

10 Jim, do you want to say anything at this
11 point?

12 MR. CAMERON: Yes, Jim Lieberman.

13 MR. LIEBERMAN: Jim Lieberman.

14 Basically, the proposal in Part 7x
15 reflects the concepts which are in the Section 3116,
16 so that the National Defense Authorization Act of
17 2005, as well as in the Commission's West Valley
18 policy statement on decommissioning, where you are
19 focusing on meeting the performance objectives of Part
20 61 based on site-specific performance assessment.

21 There is some discussion of Class C. If
22 it's Class C, then it would meet low-level waste. If
23 it's not Class C, then you have to do the site-
24 specific performance assessment.

25 MR. CAMERON: Thank you, Jim.

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1 MR. McCULLUM: And, Jim, that would be the
2 WIR category? Yes?

3 MR. CAMERON: Okay. Thanks, Rod.

4 Let's see if there's any reaction to that
5 from around the table.

6 Arjun, what are your thoughts on that
7 approach?

8 DR. MAKHIJANI: Well, you know, to say
9 that you want a hazards-based approach and then you
10 want to say waste incidental to reprocessing is
11 contradictory because waste incidental to reprocessing
12 is an origin-based approach, not a hazard-based
13 approach. You are saying, well, certain kinds of
14 waste coming out of this particular process will
15 automatically be disposed off in a certain kind of
16 way.

17 So industry should make up its mind. Do
18 you want special accommodations to reprocessing, so
19 that every particular waste stream will have its own
20 incidental whatever the current lobbying environment
21 might determine it to be? Or are we going to have a
22 hazard-based system?

23 Secondly, if we are going to have risk-
24 informed, 10 CFR 61 already has a risk/performance
25 standard. It is in subpart C. We have been talking

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1 about 10 CFR 61, Part 55, where the classification is
2 detailed, but subpart C has the dose standard. It is
3 not necessarily as strict as everybody would want, but
4 it's not bad. We have never in the past thought that
5 we should be messing with it.

6 So I would suggest that the talk of risk-
7 informed should not include subpart C. Subpart C is
8 pretty solid. It is in line with the EPA 40 CFR 190.

9 It is approximately the same or I think the dose
10 limits are actually the same, if I remember correctly,
11 Alex. Thank you, Alex. And so I would suggest
12 strictly hands-off subpart C because then you will
13 have a conflict with the EPA and problems.

14 So we are going to look at a more rational
15 system of waste classification that is certainly more
16 inclusive because 61.55 is not inclusive. Then we
17 should have, first of all, an agreement that we are
18 not going to mess with subpart C. Then we know what
19 the risk limits are, the dose limits are, and we can
20 talk. And I think then we should abandon ideas about
21 waste incidental to reprocessing.

22 Thank you.

23 MR. CAMERON: And, Rod, what do you have
24 to say about Arjun's hazard source claim? And I'll go
25 to Jim, too, after you're done, if he can add

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1 anything.

2 MR. McCULLUM: I apologize, you know, I
3 thought I was being asked a question. But we
4 definitely intend for waste incident to reprocessing
5 to be a hazards-based category. And that's what Jim
6 was talking about when he mentioned the site-specific
7 performance assessment.

8 What you have right now is waste that
9 perhaps falls into the high-level waste category
10 simply because of its origin, and that is strictly
11 origin-based. We are taking waste that the reason --
12 and maybe we need a different title. I think that may
13 be a valid point, but we have already got a precedent
14 with WIR.

15 It is taking a category of waste that is
16 currently right now categorized based on origin and
17 providing a mechanism, a methodology, to -- and this
18 gets back to what was said at the very beginning. You
19 know, the category of waste drives the disposal path.

20 To determine the disposal path based on its actual
21 hazard, that is, I believe, what Jim is talking about
22 when he says site-specific performance assessment.

23 MR. CAMERON: And that's a great
24 clarification, I think.

25 Jim, do you want to add any more?

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1 MR. LIEBERMAN: Many people talk about
2 high-level waste as origin-based, and that's true in
3 part. But the definition of high-level waste is the
4 highly radioactive material resulting from recycling,
5 et cetera. It is not all radioactive material from
6 recycling; it's the highly radioactive.

7 So you begin with the source is recycling,
8 but is it highly radioactive? And the history of WIR
9 over the years, and WIR started back in the draft
10 Appendix D back in 1969 from the AEC issue that we
11 have talked about before.

12 The highly radioactive, we would argue, is
13 material that is not sufficient to be disposed of in
14 near-surface disposal and meet the performance
15 objectives of Part 61 in the subpart C that Arjun was
16 talking about. So, if material can be disposed of in
17 near-surface disposal and meet the performance
18 objectives of Part 61, then, by definition, it is not
19 so highly radioactive that it should be considered
20 high-level waste. So that is the hazard part, the
21 risk part defined in WIR.

22 MR. McCULLUM: And just to complete the
23 clarification, so we are asking the staff to go down
24 that path in Part 7x, and then to look at Part 61, and
25 do they match up? And, you know, I wouldn't say that

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1 I'm automatically saying, oh, you've got to go redo
2 Part 61. I want to make sure that's clear.

3 But I think you need to look at this
4 broader -- and you know, the EPA is here in the room.

5 So, if it involves EPA regulations, you do need to
6 not just carve out a new regulation that accomplishes
7 this goal of a hazards-based WIR, but make sure that
8 the other parts of two agencies' regulations are all
9 on the same page here. So it is a large challenge,
10 but it is one that feels worth undertaking.

11 MR. CAMERON: And as Jim pointed out,
12 subpart C, Part 61, is integral to the approach.
13 Okay. Good. I just wanted to make sure that Arjun
14 understood that.

15 Arjun, go ahead, and then we are going to
16 hear from Phil.

17 DR. MAKHIJANI: Let me actually agree with
18 part of what Jim said about high-level waste. We
19 understand that it is partly arising out of
20 reprocessing, but we've got high-level waste and spent
21 fuel in the same category for a reason, because they
22 are very hazardous and they contain almost all the
23 fission products. And we understand that
24 radioactivity hazards arise from the fission products.

25 But the immediate radiological hazard is

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1 not the main thing we're talking about in waste
2 management, other than when you are talking about
3 nuclear waste and tank explosions and leaks and things
4 like that, operational issues.

5 When you are talking about waste disposal,
6 you are talking about longevity is a very important
7 part of that. So one of the reasons, for instance,
8 that I would oppose any definition of waste incidental
9 to reprocessing, if you've got a lot of iodine-129,
10 the DOE wants to dispose of it in cement. You've got
11 a lot of strontium-90. You've got a lot of
12 cesium-127. We don't think cement is very good for
13 300 years, let alone 300,000 years.

14 And the idea that hazard is not a one-
15 dimensional quantity, you've got a water dilution
16 volume that you can use to define hazard, and we do
17 it, and you do it; the National Academy does it.

18 But you've got a longevity element. And
19 the thing that came up in the Depleted Uranium
20 Workshop that I alluded to earlier in October that was
21 an element of consensus of everybody is that you can't
22 have very long-lived materials in shallow burial
23 because you can't model it.

24 I mean, otherwise, you could just put
25 high-level waste in Clive, Utah because, if you were

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1 sure the clay cap wasn't going to erode for 1 million
2 years, then why not just put high-level waste? Why
3 have all this aggravation of a deep geologic
4 repository?

5 So hazard for waste disposal is a
6 multidimensional thing. It is not just the hazard for
7 a worker in a chemical or a radiological facility.

8 And you can't have waste categories like
9 waste incident to reprocessing that mix long-lived and
10 short-lived radionuclides and say this is okay to
11 dispose of in shallow-land burial because it is not a
12 lot of radioactivity.

13 The allowable amount of iodine-129 in
14 water is just 1 picocurie per liter. The Savannah
15 River is already contaminated. You have a discharge
16 point of the Savannah River Site not far from 1
17 picocurie per liter.

18 And we're asking for tritium to be 400
19 picocuries per liter, not 20,000 picocuries per liter.

20 And I think it is going to happen one day.
21 California already has a health advisory level,
22 guidance level, of 400 picocuries per liter, and you
23 probably know that.

24 So we have got a one-dimensional
25 definition of risk today, which is cancers, but it is

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1 not necessarily the most important risk for tritium in
2 water. I don't think it is, actually, the most
3 important risk for tritium in water.

4 So, if we are going to talk hazard-based,
5 you have got to talk about fetal protection; you have
6 got to talk about pregnant women protection; you have
7 got to talk about multidimensional health endpoints;
8 you have got to talk about longevity; you have got to
9 talk about dose conversion factors. And we will leave
10 the uncertainty about cancer risk coefficients aside
11 because I think it is actually a minor problem in
12 hazard assessment.

13 So I would support a hazard assessment
14 that were true to the idea of hazard assessment and
15 leave subpart C alone.

16 And the special categorization that I've
17 got three waste streams coming out of my factory that
18 are automatically waste incidental to reprocessing and
19 pretend that it's hazard is, I think, unscientific
20 from the word go.

21 MR. CAMERON: Okay.

22 DR. MAKHIJANI: Industry should give us a
23 new paper.

24 MR. CAMERON: Thank you, Arjun.

25 Phil? And then we'll go to Ed Lyman.

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1 MR. REED: I would just like to make two
2 points here.

3 With regard to standards, the low-level
4 waste standard, the low-level waste regulation, Part
5 61, has several standards built in.

6 First of all, the standard for the dose
7 requirement is 500 millirems, which is based on
8 intrusion, and from that, we derive the concentration
9 levels in Tables 1 and 2 of Part 61.

10 But there is also another standard for
11 Class B and C of Part 61, which is Section 61.56(b),
12 and those are the stability requirements. The
13 regulations specifically state that you have to
14 consider radiation, you have to consider biological
15 effects, and other things, if you decide to solidify.

16 If you want to put them in a high-integrity
17 container, fine, you are allowed to do that.

18 If you do decide to solidify, there is
19 another standard, and that is the NRC Branch Technical
20 Position. There are standards in there for leaching.

21 There are standards in there for compression. There
22 are standards in there for microbial degradation, and
23 there is a radiation standard in there. I believe it
24 is 10 to the 6 rads per hour. Don't quote me on that,
25 but I think it's fairly close to that. So the low-

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1 level waste essentially does have a lot of standards.

2 The second question I wanted to address is
3 this concept of WIR. As I understand the industry,
4 they are saying that, if you have an operating
5 reprocessing facility, and let's suppose we had one
6 operating out here today, if you have waste that is
7 coming out of the reprocessed material, the facility,
8 and if that waste is in high volume, and if that waste
9 has concentrations that are less than what you have in
10 10 CFR Part 60, Tables 1 and 2, you can take that
11 waste and bury it in a commercial land bury facility.

12 Now you may call the waste low-level
13 waste. You may call it WIR. It really doesn't make
14 any difference.

15 What is important is that that waste
16 stream happens to meet the concentrations in Tables 1
17 and 2. Therefore, you can bury it in a commercial
18 low-level waste facility, as I understand it.

19 For high-level waste, I don't know who
20 sets the standard for high-level waste. I believe
21 those standards are set by DOE, if I'm not mistaken,
22 for the waste that is vitrified. I believe that is
23 the way it -- I'm not sure on that. Maybe perhaps DOE
24 or somebody else can comment on that.

25 But I don't believe that we have detailed

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1 performance standards for glassified or vitrified
2 waste that would eventually end up in a repository.
3 So I am not sure on that.

4 MR. CAMERON: Maybe does anybody have a
5 clarification on who sets the standard on that? Yes,
6 sir? And please introduce yourself to us.

7 MR. HILL: Excuse me. I'm Britt Hill.
8 I'm NRC staff in NMSS.

9 There is no standard NRC regulations for
10 the activity levels in vitrified waste that would then
11 be placed in a repository. The Department of Energy
12 established some technical specifications based on
13 their views of the performance requirements, but they
14 were internally-generated and not based on NRC
15 regulations. So we don't have any limit, if you will,
16 on the activity levels for high-level waste.

17 MR. CAMERON: Thanks, Britt.

18 Arjun, we need to --

19 DR. MAKHIJANI: I don't believe there is a
20 500-millirem limit in 10 CFR 61 for intruders. I'm
21 looking at it. It doesn't have a number in it. It
22 may be from somewhere else, but it's not in 10 CFR 61.

23 MR. LEE: Yes, the 500-millirem is based
24 on this Staff Technical Position on low-level waste
25 performance assessment.

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1 DR. MAKHIJANI: It's not in 10 CFR 61.

2 MR. LEE: That's correct.

3 MR. CAMERON: I am glad that Arjun and you
4 are agreeing on your characterization of something
5 now. I think we're making progress here.

6 MR. LEE: There you go.

7 MR. CAMERON: Okay.

8 MR. LEE: I just wanted to follow up with
9 Britt on just a couple of items.

10 One, at one time, the DOE programs had
11 Waste Acceptance Criteria for each of their glass
12 production facilities, and those Waste Acceptance
13 Criteria were, I guess, developed in concert with the
14 EPA standard and knowledge of how or suggestions of
15 how to dispose of -- how Yucca Mountain might perform
16 or a geologic repository. So that is how you arrived
17 at the mix, if you will, of the glass composition that
18 was used to make the waste.

19 So I believe, at the end of the day, the
20 EPA standards for spent fuel and high-level waste are
21 kind of driving the bus.

22 MR. CAMERON: Okay. Thank you, Mike.

23 Let's go to Ed, check in with Rod, and
24 just see if there are any final cautions for the NRC
25 in terms of this rulemaking and waste.

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1 Ed?

2 DR. LYMAN: I missed the beginning of this
3 discussion, so I don't know if this came up. But I
4 recall that in the White Paper there was a proposed
5 definition of high-level waste that just mentioned
6 fission products in sufficient concentrations. And it
7 was pointed out at a previous meeting that it doesn't
8 mention transuranics, which may not be covered in the
9 definition of fission products, and that that could be
10 a significant loophole.

11 Has that been addressed yet here?

12 MR. CAMERON: No, we haven't, and let me
13 ask Rod or I can go over to Jim Lieberman.
14 Clarification on fission products versus transuranics
15 covered --

16 MR. McCULLUM: Are you referring to
17 specifically the October 2009 White Paper?

18 DR. LYMAN: I don't have the White Paper
19 in front of me, but --

20 MR. McCULLUM: That's an industry
21 presentation.

22 DR. LYMAN: -- the industry
23 recommendation.

24 MR. McCULLUM: Okay. Yes. I defer to
25 Jim, who is one of the authors of that.

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1 MR. CAMERON: I think we'll get a
2 clarification here. Jim Lieberman?

3 MR. LIEBERMAN: Ed is correct. Both the
4 Part 7x as well as the October 2009 White Paper talked
5 about fission products because that's the definition
6 from the Nuclear Waste Policy Act, which is also in
7 the Atomic Energy Act, that says, "in any solid
8 material derived from such nuclear waste that contains
9 fission products in sufficient concentrations."

10 So the legal definition that we are
11 working under has the fission products. So that is
12 the source of that.

13 The TRU question is a good question that
14 needs to be considered in the process.

15 DR. LYMAN: Right, because you could argue
16 that a high actinide waste stream may not be, quote,
17 "highly radioactive", unquote, based on activity, but
18 is significant radiologically.

19 MR. CAMERON: Okay. Thank you, Ed.

20 TRU needs to be addressed. Rod?

21 MR. McCULLUM: Yes, I just wanted to
22 close, and I promise I won't try to get another word
23 in on this, by agreeing with Arjun on the point that
24 the hazard of WIR would have to include the longevity.

25 And I think that gets to the question that

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1 just arose. You do have to take a holistic look at
2 it. And that's why in proposing a hazards-based
3 categorization scheme, again, alluding to what Jim
4 said, site-specific performance assessments, a
5 performance assessment lets you look at all aspects of
6 the hazard.

7 There may be a category of waste within
8 WIR above Category C that would require some form of
9 engineered disposal other than a repository, but
10 certainly more than a shallow-land disposal.

11 And a site-specific performance assessment
12 would allow you to safely design that. So, really,
13 again, what was said before, that the classification
14 drives the disposal path, in fact, that's how we
15 connect all the dots in terms of our goal here, which
16 is protect public health and safety and the
17 environment, and in this case, to do so for a very
18 long period of time.

19 So I would agree with Arjun that we need
20 to look at all that stuff.

21 And, Jim, you can correct me if I'm wrong,
22 but that is why our proposal was written the way it
23 was, to rely on that for category of waste, a site-
24 specific performance assessment.

25 MR. CAMERON: Okay, and Miriam is going to

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1 check in with the public, and, Jim, she can check in
2 with you, if you have something to add there.

3 MR. LIEBERMAN: Yes, if I could add one
4 more point, Phil mentioned that in the proposed
5 definition we had, if it is a Class C, that it would
6 be low-level waste. Since that paper was written, the
7 Commission has focused on depleted uranium and unique
8 waste streams of blended waste.

9 And probably we might want to have a
10 modification of this to require the site-specific
11 performance assessment for all waste streams when you
12 are dealing with quantities of waste that wasn't
13 considered in the EIS that supports Part 61. Even if
14 a particular radionuclide was considered in an EIS, a
15 waste stream might be different and, thus, a PA is
16 appropriate.

17 MS. JUCKETT: Any other comments?

18 MS. SUPKO: Eileen Supko, Energy Resources
19 International.

20 Could you go back to the slide with the
21 graphic of material balances? I just have a few
22 comments on this.

23 It's a little bit inartful, and
24 particularly, Chip, you said that the meeting in
25 Albuquerque may have more members of the general

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1 public. And at least the way it appears to me, I
2 think most people in this room have a technical
3 background.

4 So you look at it and you see, for
5 example, reprocessed uranium coming out as an
6 outstream. It appears that maybe that is considered
7 to be a waste stream, when REPU is not necessarily
8 going to be waste. It is being recycled today. In
9 Europe, EDF is recycling the REPU. Other countries
10 have recycled REPU.

11 And I don't necessarily think you should
12 call it a waste stream. It is something to consider
13 because, when you are adding up, gee, comparing a
14 once-through fuel cycle with a single recycle through
15 a Light Water Reactor, and you add up REPU as a waste
16 stream, that is bumping up the waste quantities.

17 Someone was talking about earlier today,
18 if you are not considering that to be a waste, then
19 you have got a different balance going on. So you
20 need to be really careful about what you are
21 comparing.

22 Also, you are showing MOX fuel coming out
23 of that box in the middle. And that is true if you
24 are talking about reprocessing and recycling. But you
25 might want to make it a little bit more clear.

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1 What is initially coming out of the
2 reprocessing is plutonium, and maybe that is
3 purposeful because you don't want to use the word
4 "plutonium"; I don't know.

5 But just be careful about how it is that
6 you are describing what is going to go on, when you
7 are talking to members of the general public. There
8 are different things.

9 Another comment I heard earlier was that,
10 if you recycle, you are increasing the total volumes
11 of waste. That is not necessarily true. The more we
12 move to advanced fuel cycles, fast reactors, and
13 recycle different materials, total volumes of waste
14 are expected to go down.

15 In addition, there are other important
16 parameters that we need to consider when we are
17 looking at the fuel cycle. One is uranium
18 utilization. As you go to more advanced fuel cycles,
19 you are using less uranium. That is going to become
20 more and more important as countries around the world
21 start moving toward nuclear energy and increasing the
22 use of uranium supplies.

23 Something else? Oh, there is also -- I
24 would recommend this, if NRC staff hasn't seen it --
25 there is a Nuclear Energy Agency OECD study that was

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1 put out, I want to say it was in 2006, which was a
2 comparison of advanced fuel cycles. And in it, they
3 do a comparison of a wide range of parameters:
4 quantities of high-level waste and spent nuclear fuel,
5 quantities of low- and intermediate-level waste, both
6 short-lived and long-lived, in about seven or eight
7 different fuel cycles. They also look at
8 transuranics, uranium utilization, ultimate heat load
9 of the material being disposed of. Those are all
10 important parameters.

11 And I believe that you can download the
12 document from the NEA's website. I recommend it.

13 Thank you.

14 MR. CAMERON: Okay. Thanks, Eileen.

15 I think Alex, I see him making notes, and
16 if he needs more on that reference, he will ask you.

17 But I think your main point is that this
18 may be misleading or at least needs to be caveated in
19 some respect.

20 MS. SUPKO: It is a lot of information for
21 one slide.

22 MR. CAMERON: Okay. Ed, do you want to
23 say anything on this?

24 DR. LYMAN: Yes. I agree with the point
25 on plutonium. You should definitely show that would

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1 be producing about 10 tons of plutonium.

2 With regard to reprocessed uranium, the
3 recycling of reprocessed uranium is extremely low. I
4 think it is about 2 percent in two reactors in France.

5 Most of it is done as re-enrichment in Russian
6 centrifuge plants because URENCO doesn't want to
7 contaminate its centrifuges to a great extent by
8 recycling this contaminated material.

9 There's absolutely no evidence that it is
10 economic. So it should be considered a waste product
11 for all intents and purposes for the near future.

12 MR. CAMERON: Thank you, Ed.

13 Jim?

14 DR. BRESEE: Yes, just one minor point
15 with regard to recycling uranium. It is a practical
16 process when a country is able to combine, as can
17 China and several other countries, Light Water and
18 Heavy Water Reactors.

19 And there is an experiment currently
20 underway involving, in cooperation between Canada and
21 China, on the direct recycle without re-enrichment.

22 It will at some point be a factor in
23 analysis of total fuel cycle cost. So far, we are
24 simply collecting information, but that is one
25 combination where direct recycle without re-enrichment

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1 is technically-feasible.

2 MR. CAMERON: Okay, thank you. Thank you
3 very much, Jim.

4 Any final comments on the waste area
5 before we move on to Marshall Kohen and security and
6 safeguards?

7 Alex?

8 MR. MURRAY: Hi, Chip. I'm back again.

9 Can we just scroll to the last slide of
10 this presentation, please? Oops, too far.

11 I would just like to mention to everybody
12 in this room, you know, we put down some potential
13 points for discussion here. These included some
14 aspects related to storage; what parameters might be
15 appropriate there, if any; any reuse scenarios, be
16 they for reprocessed uranium, what have you; any
17 standards any reused materials might have to meet or
18 should meet or could meet, or what have you.

19 Please, if you have any thoughts or
20 comments on those, submit them to the NRC for our
21 consideration.

22 Thank you.

23 MR. CAMERON: Thank you for that, Alex.

24 Mike, thank you for teeing it up for us.

25 Okay.

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1 There's a break scheduled in here at 2:15
2 that we're going to just skip. Okay? Although I know
3 everybody likes to take breaks, but we may get out a
4 little bit early this afternoon. Who knows?

5 But we have Marshall Kohen with us, who is
6 going to tee-up the next agenda item, which is
7 security and safeguards.

8 We have a name tent for you, Marshall.

9 MR. KOHEN: While the presentation is
10 coming up, thanks, Chip. We appreciate the
11 opportunity to tee-up the discussion of issues dealing
12 with safeguards and security as it relates to
13 reprocessing and recycling.

14 I work in the Office of Nuclear Security
15 and Incident Response in NRC, specifically in the Fuel
16 Cycle and Transportation Security Branch. We have
17 been the branch that has sat as representative of NSIR
18 on the Reprocessing Rulemaking Working Group for the
19 past year or so.

20 For those of you who do not know, this
21 presentation is about safeguards and security. The
22 safeguards or the MC&A group in NRC is actually in the
23 Office of Nuclear Material Safety and Safeguards. The
24 security policy group is actually in my office,
25 Nuclear Security and Incident Response.

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1 So, by way of introduction, I am going to
2 do the presentation today, but there are, I guess,
3 some aspects of MC&A, and we have Tom Pham here from
4 NMSS who can speak more authoritatively about the MC&A
5 aspects.

6 I think what I would like to do today by
7 way of kicking the topic off is sort of to give you a
8 snapshot of where we are in terms of physical
9 protection today, what we have in terms of what you
10 are going to see in material categorization, how the
11 material is categorized, and a little bit about the
12 physical protection that evolves from that
13 categorization, but how it would impact
14 reprocessing/recycling, if it were to occur today.

15 So some of this may be pretty basic, and
16 you all may know it, but I figured I would start with
17 stuff to sort of ramp up to a little bit more
18 specific.

19 The primary regulations for safeguards and
20 security are in 10 CFR 73. That is the physical
21 protection aspects. 10 CFR 74 is the material control
22 and accounting aspects.

23 To start by talking about special nuclear
24 material, SNM, what is SNM? Well, SNM comprises
25 plutonium, uranium-235, and uranium-233. We divide

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1 SNM into three categories for purposes of signing
2 requirements for security and MC&A.

3 Those categories are based on or the
4 categorization scheme is based on the potential for
5 that material to be either directly used in a nuclear
6 fissile explosive or indirectly in the production of
7 materials that would be used for that purpose.

8 An interesting and very important point
9 here is that the categories that you are going to see
10 in a second are primarily based on the quantity of
11 material that we are talking about as well as for
12 U-235 the enrichment level.

13 So here you see the table that I am sure
14 many of you are familiar with. I don't want to go
15 into every detail of this, but I think it gives sort
16 of the overall picture of, if you have a type of
17 material at your facility, where would it be placed in
18 terms of categories?

19 So you see what we would call the formula
20 quantities for plutonium would be 2 kilograms, would
21 put you in Category 1, and for 5 kilograms would you
22 put you in Category 1 for uranium-235 or what we would
23 call HEU, highly-enriched uranium greater than 20
24 percent.

25 U-233 is the similar threshold for

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1 Category 1 as plutonium. In NRC terminology, the
2 Category 1 quantity would be termed strategic special
3 nuclear material. Category 2 would be special nuclear
4 material of moderate security significance, strategic
5 significance. And Cat 3 would be material of low
6 strategic significance.

7 So what is the current categorization and
8 how would it impact reprocessing and recycling? All
9 of the current reactor, nuclear reactor, fuels would
10 be Category 3 materials.

11 And if we could go back one, if you would,
12 Jose?

13 The reason is because they are of low
14 enough enrichment that, regardless of the quantity, it
15 would put them in Category 3. If you see the fourth
16 row down, even HEU -- oh, sorry. It would be LEU.
17 Between the 10 percent and natural would put it
18 automatically into Category 3.

19 Reprocessing and recycling would introduce
20 plutonium, obviously, as well as potentially other
21 transuranics.

22 Fuels containing greater than 2 kgs of
23 plutonium would be Category 1, and it is based on the
24 table that we just showed, regardless of the isotopics
25 or the form or the presence of other materials. And

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1 here we are talking about the concept of
2 attractiveness, the attractiveness of the material for
3 use in the nuclear device. Other TRUs, for example,
4 americium and neptunium, have SNM-like characteristics
5 in that regard.

6 The current regulations do not consider
7 the other TRUs. That is the physical protection
8 regulations in NRC parlance do not consider the
9 americium, neptunium, and other TRUs. Plutonium,
10 likewise, is categorized without consideration of the
11 form or the isotopic composition.

12 As you may know, we have received an SRM
13 from the Commission to proceed with revising the
14 current categorization approach to include the concept
15 of attractiveness as part of our upcoming fuel cycle
16 security rulemaking.

17 We intend to, and have been charged with,
18 engaging the public in a very widespread way in terms
19 of outreach during that process. That process is
20 beginning. The technical basis is beginning. So
21 that's, again, a long-term rulemaking, but that is
22 something that we will be coming to the public to have
23 discussions about.

24 In terms of MC&A, 10 CFR 74.51 currently
25 has an exclusion for reprocessing facilities from the

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1 Category 1 MC&A requirements. So what that sets up is
2 the fact that a Category 1 reprocessing facility
3 wouldn't have the same MC&A requirements as other
4 Category 1 facilities or those facilities that have
5 Category 1 materials.

6 So, as was discussed at length yesterday,
7 it sort of sets up a situation in which we have
8 requirements that aren't necessarily consistent
9 between facilities with similar categories of
10 material.

11 My understanding -- and Tom can amplify on
12 this -- is that there is a plan within the staff right
13 now to remove the exemption in Part 74, and so to move
14 closer to a more consistent regulatory basis in that
15 regard.

16 So I think that concludes my sort of
17 formal remarks. I would just, as other speakers have
18 done, let Chip start working from the list of topics
19 for discussion.

20 MR. CAMERON: Thank you, Marshall. That
21 was very good.

22 Tom, do you want to add anything before we
23 get started? Okay.

24 It is interesting, the attractiveness
25 level comment. Maybe that's a good place to start.

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1 Anybody have anything to say on what needs
2 to be done in terms of safeguards and security or
3 safeguards.

4 Rod?

5 MR. McCULLUM: Well, I am not going to get
6 into a lot of detail on this topic, but ask my
7 colleague here to weigh-in. He follows this more
8 closely than I do.

9 But again, consistent with the approach --
10 and I agree the regulations need to be consistent. We
11 would think they need to be consistent -- here it
12 comes -- in a risk-informed manner, which means to us
13 based on hazard.

14 You look at things like plutonium is
15 categorized without respect to former isotopic content
16 or composition. I'm sorry. That's problematic for
17 us. I hope Dan will speak a little bit about some of
18 the issues that that could cause for us.

19 But you should look at plutonium, and
20 plutonium in MOX with other isotopes that are
21 radioactive in low concentrations is not the same
22 thing in terms of attractiveness as weapons pure
23 plutonium. So we would hope that you would take this
24 opportunity to make the regulations consistent and
25 address that.

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1 Dan, will you speak to that?

2 MR. CAMERON: Go ahead, Dan.

3 MR. STOUT: Sure. There is interplay
4 between the security aspects and the safeguards
5 aspects that need to be taken in tandem as you look
6 going forward.

7 And we do encourage you to consider
8 attractiveness in updating the table. MOX assembly is
9 not the kind of thing that someone is going to grab
10 and go run off with.

11 When we pull the uranium out of the
12 reactor, there is a significant fraction of it that
13 already has plutonium, and it has been created as part
14 of the fission process. So it is not, from a
15 technical perspective, anything that we are not used
16 to.

17 From a security standpoint, it is the kind
18 of thing that this country can protect, and it is the
19 kind of thing that regulations can be put in place to
20 allow transportation, handling, storage, use very
21 similar to other things that we are used to dealing
22 with.

23 MR. CAMERON: Okay. Thank you.

24 Ed?

25 DR. LYMAN: Yes, let me rephrase what's

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1 going on here. In April of this year, President Obama
2 hosted a Nuclear Security Summit where one of the
3 objectives was to increase security on weapons-usable
4 materials wherever they're found, to lock down all
5 vulnerable materials within four years.

6 And what is happening here is TVA and NEI
7 have gone to the Commission and said, "We can't afford
8 to transport MOX fuel using SSTs. You have to
9 downgrade the security on these materials."

10 And you went to the Commission, and we
11 don't know what's in the SRM because it's not public
12 yet, as far as I know. I haven't seen it.

13 But what is going on here is completely
14 out of line, inconsistent with the risk, the nuclear
15 terrorism and proliferation risk associated with
16 weapons-usable materials.

17 The National Laboratories conducted a
18 study, an extensive study, and found that
19 plutonium/uranium mixtures are highly attractive until
20 the uranium concentration exceeds about 80 percent,
21 and even then, they are still usable in weapons,
22 although not the most highly-attractive material.

23 Fast reactor fuel would probably be beyond
24 20 percent plutonium and would, therefore, still be a
25 highly-attractive material for nuclear weapons use.

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1 There's absolutely no technical basis for
2 downgrading the security on MOX fuel, whether it is
3 Light Water Reactor or fast reactor fuel. And I guess
4 whether the Commission is fully apprised of all the
5 information that the nuclear weapons laboratories have
6 on the improvised nuclear device risk associated with
7 these materials, can I just ask, how many NRC staff
8 have access to Sigma 20 nuclear weapons data?

9 MR. KOHEN: That's not something that I
10 have complete familiarity with. I imagine it is a
11 relatively low number.

12 MR. CAMERON: So, Ed, I take it, and I'm
13 not trying to be disingenuous here, but you think this
14 whole idea of risk-informing Part 73 and 74 is a bad
15 idea?

16 DR. LYMAN: This isn't risk-informing
17 because, as far as I know, it is not based on a well-
18 defined, credible adversary.

19 Well, first of all, you can't risk-inform
20 security in the strictest sense because risk-informing
21 is a quantitative process, and you can't assign a
22 probability to the threat of a terrorist incident,
23 whether it be a sabotage attack or a diversion or
24 theft of nuclear material. It simply can't be done.
25 So risk-informing is not even appropriate to talk

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1 about when you are talking about deliberate acts.

2 Second of all, if you are talking about
3 the relative risk of various materials, it has to be
4 based on credible adversaries, looking forward. We
5 are talking about implementing rules that will be
6 around for a very long time.

7 The capabilities of adversaries only
8 continue to increase, and whatever intrinsic relative
9 attractiveness of the materials themselves can be
10 overcome today -- and as adversary characteristics
11 continue to increase, it will become even easier to
12 overcome.

13 So there is really no technical basis for
14 any reduction in the current security requirement,
15 based on the so-called material attractiveness, these
16 principles.

17 MR. CAMERON: Okay. Thank you.

18 Then Tom? Marshall?

19 MR. KOHEN: Yes, I guess I would say two
20 things.

21 First, we haven't completed all of our
22 deliberations, obviously. As I said, we are beginning
23 the process of the development of the technical basis.

24 So I'm not implying today that there is going to be a
25 decrease in physical protection for any particular

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1 type of material. I'm not saying either way. We
2 haven't gotten there yet.

3 And I guess the second point that I would
4 make would be that we are going to do what we feel is
5 necessary in terms of technical studies, in terms of
6 technical analysis, to be able to back up whatever
7 recommendations we make in terms of revising the
8 categorization table and assigning appropriate
9 physical protection based on those thresholds and
10 based on the attractiveness that we find is
11 appropriate.

12 So this is not a throw the dart at the
13 problem. We are going to be doing technical analysis
14 to substantiate what our recommendations are going to
15 be.

16 MR. CAMERON: And do we know what's in the
17 SRM? Is the SRM public?

18 MR. KOHEN: The SRM was originally labeled
19 OUO/SRI. The Commission, I don't know that there was
20 ever a final decision from the Commission as to
21 whether they wanted to release the SRM and make it
22 publicly releasable.

23 There is indication that that could
24 happen, and I understand that at least one
25 Commissioner agreed to release his vote sheet on the

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1 topic. But I have not seen that officially, and so I
2 would be a little bit hesitant to discuss the details,
3 not having seen an official response from the
4 Commission saying that they agree to it being
5 publicly-releasable.

6 MR. CAMERON: Okay, but you characterized
7 the Commission's directive, is it proper to
8 characterize the Commission's directive to the staff
9 as you should look to risk-informing Part 73 and 74?

10 I'm not trying to put words in your mouth.

11 If you give people sort of a general characterization
12 of what the Commission asked you to do, if not why?

13 MR. KOHEN: I think it's fair to say that
14 the Commission gave us the go-ahead to go forward to
15 do the rulemaking that we asked to do, that is on the
16 ballot, and that attractiveness was an acceptable
17 aspect of a process to achieve that rulemaking, a part
18 of that rulemaking.

19 MR. CAMERON: Okay. Thanks, Marshall.

20 Go ahead.

21 MR. LOEWEN: This is from the results of a
22 FOIA on materials associated with TVA's interest in
23 the MOX fuel program, which was filed by Tom Clements
24 of Friends of the Earth.

25 And this is the summary of a TVA meeting

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1 held 22 April 2009, and in attendance were TVA, AREVA,
2 MOX Services, ORNL, and DOE, including Dan Stout is
3 listed both under TVA and DOE here.

4 I would just like to read this. "Meeting
5 discussion. Much of the work on PWR and BWR MOX is
6 being performed by AREVA and should be completed by
7 August 2009. This includes trying to revise the NRC
8 material classification such that fresh MOX fuel can
9 be more easily transported."

10 So I just wanted to put that in, if
11 there's any confusion about where this came from.

12 MR. CAMERON: Okay. Alex, and then we
13 will go to Rod. Alex Murray.

14 MR. MURRAY: Hi there. Thanks, Chip.

15 I have just two comments, two points I
16 would like to make. One may actually be a question
17 for both Ed and for Dan here.

18 Ed, I heard you say something about
19 greater than 80 percent uranium in a fuel. That's
20 when its, quote, "attractiveness" started decreasing.

21 I just wanted to know, I think you were talking from
22 a perspective of fast reactor fuels.

23 And I guess my question for Dan here is,
24 were you talking about fast reactor fuels for MOX or
25 LWR MOX fuels? Because the LWR MOX fuels are normally

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1 more than 80 percent uranium. So that is my first
2 point, and I would like you guys to clarify that.

3 And my second, I guess, is more of a
4 question than a point. I have been in public meetings
5 before where members from the National Labs have made
6 a public presentation with a comment where, as I say,
7 the isotopics do make a difference.

8 And I would like to ask the panel at large
9 their thoughts on that, if any, particularly the
10 presence or absence of other isotopes like
11 plutonium-238, potentially the addition or removal of
12 neptunium, et cetera.

13 Thank you.

14 DR. LYMAN: Let me just clarify what I
15 said. The study, which was headed by Charles Bathke
16 at Los Alamos, only looked at the direct usability of
17 materials in nuclear weapons.

18 When the mixtures of plutonium and uranium
19 were concerned, there is a threshold once the uranium
20 concentration gets above that 80 percent. That is
21 only associated with direct use of the material in a
22 weapon without any processing. It does not take into
23 account the fact that, if the material were stolen,
24 the plutonium could be easily separated, if desired.

25 Originally, this was characterized by Los

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1 Alamos as the difference between being attractive and
2 being unattractive. They have now changed those
3 designations to impractical and very impractical. So
4 they have actually eased away from using the term
5 unattractive, even with reference to material where
6 the plutonium is diluted below that 20 percent.

7 But, again, that doesn't have to do with
8 the question of separation. It is only the direct
9 usability of the mixture.

10 MR. MURRAY: May I just ask, Ed, what is
11 the term they are using now -- I didn't quite catch it
12 -- please?

13 DR. LYMAN: Impractical and very
14 impractical.

15 MR. MURRAY: So, if it's greater than 80
16 percent uranium, it would be very impractical?

17 DR. LYMAN: Very impractical.

18 MR. MURRAY: Okay. Thank you very much.

19 DR. LYMAN: With regard to isotopics, the
20 DOE's formal position is that all, with the exception
21 of almost pure 238, any isotopic mixture can be used
22 in nuclear weapons, but if you are talking about an
23 advanced nuclear weapons state, that there is
24 essentially no -- that an advanced nuclear weapons
25 state can use plutonium of almost any isotopic

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1 composition to build weapons with the same yield and
2 reliability as is currently stockpiled. And if you
3 are talking about terrorist groups, the yield, even
4 the physical yield, is something which would be of
5 great value to a terrorist group. So the question of
6 predetonations is not really relevant. So, in other
7 words, it is not really relevant.

8 In the most recent study by Los Alamos,
9 their conclusion was, again, that plutonium, other
10 than essentially pure 238, plutonium of any isotopic
11 composition is attractive for use in nuclear weapons.

12 MR. CAMERON: Dan, do you want to say
13 anything at this point? Go ahead.

14 MR. STOUT: Yes, I think that was near my
15 last day at DOE and my first day at TVA, and I'm sure
16 the audience was confused.

17 To answer your question, Alex, it was
18 talking about MOX in Light Water Reactors, not fast
19 reactor fuel. So we are talking about a fuel that is
20 going to contain less than 10 percent fissile
21 component. And consistent with what Ed is saying,
22 from DOE's perspective, that is less attractive for --
23 I forget the other word -- but impractical.

24 I mean, you know, yes, Ed's point, if a
25 theft of a MOX fuel assembly were to take place, that

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1 individual or activity would have to do reprocessing
2 to remove and accumulate an attractive quantity that
3 could have direct use in a weapon, and that is not
4 easily done. It is reasonable to be able to put in
5 place requirements that theft could be detected and
6 that recovery of that could be performed with high
7 confidence.

8 So the NRC needs to consider the threat.
9 You know, the consequence is part of this, the
10 probability. And in that context, detect the threat,
11 recover before something bad happens.

12 MR. CAMERON: Dan has given the rationale
13 there. Do you want to say anything on that? Then
14 we'll go to Arjun.

15 And I just want to point out that the SRM
16 is publicly available, okay, at this point. Jim
17 Lieberman just found it, and Marshall confirmed that
18 that is the SRM.

19 So you can take Jim's BlackBerry home with
20 you.

21 (Laughter.)

22 Okay.

23 DR. LYMAN: That's good.

24 With regard to separation, you wouldn't
25 have to reprocess the spent fuel assembly. You would

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1 only have to separate uranium and plutonium, which
2 would not require a shielded facility, and would
3 require a much simpler chemistry than actual
4 reprocessing.

5 So I don't know. There are very few
6 people who would say that that would be a significant
7 technical barrier. The IAEA never considered it a
8 technical barrier and considers MOX fuel to be direct-
9 use material. It requires it to be safeguarded with
10 the same intensity as separated plutonium. So that
11 barrier has never been regarded as significant. Since
12 the characteristics of adversaries are only increasing
13 with time, you can only expect the material would be
14 more vulnerable, not less over time.

15 MR. CAMERON: So this is a point you made
16 before about you really need to consider what the
17 capabilities of the adversary are on any of these
18 things.

19 Arjun? Then, I'm sorry, Rod, we'll go to
20 you. Arjun?

21 DR. MAKHIJANI: Yes, I'm glad Ed brought
22 this up. I mean plutonium in spent fuel, which you
23 alluded to earlier, is very different than plutonium
24 in MOX that's not irradiated. You can handle
25 plutonium in MOX without shielding.

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1 And as Ed said, well, there's nothing more
2 to add in regard to chemistry. It is close, it is a
3 step removed away from weapons-usable material;
4 whereas, spent fuel is regarded as the gold standard
5 of non-proliferation by the National Academy of
6 Sciences, as you know. And the chief author of that
7 report is now the President's Science Advisor, John
8 Holdren.

9 I personally think that, if you are going
10 to look at this, that the MOX facility as well as
11 transport and storage of unirradiated MOX fuel should
12 have security comparable to military facilities. It's
13 not complicated. It's very straightforward. It
14 corresponds to the facts about what MOX fuel is and
15 the security risks that plutonium poses.

16 Unirradiated MOX fuel is not a big deal to
17 handle. And just for the record, fissile in a nuclear
18 weapon is 500 tons or a kiloton of explosive power,
19 and the Oklahoma City terrorist bombing was five tons
20 of TNT equivalent, just on the order of magnitude of
21 what we are talking about here.

22 MR. CAMERON: Thank you, Arjun.

23 And Rod?

24 MR. MURRAY: Yes, I just want to clarify
25 that industry is not proposing eliminating or reducing

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1 protections here. We are talking about technologies
2 that potentially make it a safer world, where in
3 plutonium reactors you have less plutonium.

4 If the United States takes the leadership
5 in these technologies, they are in better hands.
6 Those are points, I know, of dispute.

7 Plutonium in MOX is less attractive than
8 plutonium not in MOX. It does require work. Now,
9 granted, it is not the same thing as plutonium in
10 spent fuel. I would agree with Arjun there.

11 So the level of protection, again, I'm not
12 saying less protection, but there needs to be a high
13 level of protection of MOX. It does not have to be
14 the same as SST or pure plutonium, but it needs to be
15 the appropriate level of protection.

16 With regard to isotopics, they do matter.
17 And I am glad Alex asked that question because that
18 is another piece of this.

19 Fast reactor fuels, you combine plutonium
20 with things like neptunium and americium. That's also
21 different. Again, it doesn't mean you eliminate
22 protection. It doesn't mean you leave behind
23 inadequate protections. It means you have a
24 consistent level of protection.

25 So, when something is different, when

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1 something becomes less attractive because you have
2 combined it with something else, you protect it
3 accordingly. Because, ultimately, what you are
4 talking about, again, is regulating technologies that
5 have the potential, if we appropriately manage them,
6 to make this a safer world.

7 And regulating those technologies in a way
8 that makes it overly difficult to deploy them without
9 lowering, without providing additional protections,
10 that is counterproductive. There are multiple levels
11 of safety here. And what we really want to do is to
12 have a proliferation-resistant reprocessing regime in
13 place, and what that means is the subject of much
14 debate.

15 I'm not the expert. These guys, a lot of
16 people around the table know more than I do.

17 But I think that you need a regulatory
18 framework that facilitates getting to that, and that
19 does need to recognize where there are
20 inconsistencies. And I will go back to regulatory
21 consistency. Regulatory predictability is what is
22 important there, and recognizing when things are less
23 attractive, providing appropriate levels of protection
24 for all materials.

25 MR. CAMERON: Okay. Thank you, Rod.

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1 Ed, do you have something?

2 DR. LYMAN: Yes. First of all, if you are
3 worried about plutonium and the risk of separating
4 plutonium, then why are you coming here with a
5 proposal to start reprocessing spent fuel in this
6 country, if that's your concern?

7 Second of all, let me just read the Los
8 Alamos study that also looked at mixtures of plutonium
9 and transuranics. Neptunium as a weapons-usable
10 material comparable to uranium-235 provides no
11 reduction in attractiveness when mixed with plutonium.

12 You know, the transuranics are also weapons-usable
13 and do not, again, significantly affect the material
14 attractiveness of the mixtures. It's all in the Los
15 Alamos study.

16 In fact, the conclusion of the study is
17 that "We have not identified a silver bullet
18 technology that would eliminate safeguards and
19 security issues. None of the proposed flow sheets
20 examined to date" -- and that includes COEX, all the
21 UREX variants, pyro processing, for example --
22 "justify reducing international safeguards or physical
23 security protection levels."

24 MR. CAMERON: Ed, in terms of regulatory
25 framework, I just want to make sure that I understand

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1 that this particular part of the regulatory framework
2 is being done by Marshall and Tom and their
3 colleagues. In other words, it is unlike some of the
4 other issues that are involved in the NMSS staff
5 rulemaking. Is that correct? So it is really
6 Marshall's group is in charge of this rulemaking, and
7 it is just going to apply to the reprocessing?

8 MR. HILTZ: Yes, I think it is true that
9 NSIR is responsible to lead for this rulemaking, but
10 there are elements of diversion analysis and gaps that
11 are contained within our gap analysis. They were
12 initially identified as a moderate gap, which means
13 that we didn't feel that it was necessary to address
14 that in order to have an effective regulatory
15 framework, but we did get some guidance from the
16 Commission that said go ahead and consider this
17 diversion and attractiveness as part of the
18 reprocessing framework.

19 MR. CAMERON: Okay, and that's going to
20 all come to you when you do this rulemaking, and you
21 are going to consider Ed's and other people's comments
22 on this.

23 Do we need to specifically talk about
24 diversion path analysis or is that what we are talking
25 about here? I mean I am displaying my ignorance, and

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1 none of you know.

2 Yes, Steve?

3 MR. SCHILTHELM: That's not specifically
4 what we are talking about here, but I'm not sure we
5 need to go into it. It is a technique and a
6 methodology for understanding, and I'm not sure our
7 time would be well-spent by drilling down into that
8 technique.

9 MR. KOHEN: Yes, I guess I just want to
10 make sure that the context here is understood. The
11 rulemaking that I have talked about, the physical
12 protection, fuel cycle physical protection, security
13 rulemaking is a comprehensive rulemaking for Part 73.
14 It is something that we had planned, obviously, not
15 prior to reprocessing, but I guess a complementary
16 aspect. Reprocessing would be one example of how the
17 Part 73 changes would take place.

18 It is the first comprehensive security
19 rulemaking that has been done on Part 73 in 25 or 30
20 years. There's been a lot of piecemeal, patchwork
21 revision to that part. Those of you who are familiar
22 with reactors obviously understand that.

23 But this is a look at the whole Part to
24 determine that the material that we are talking about,
25 the SNM that we are talking about is not only

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1 characterized properly, that we have done in Rod's
2 words an appropriate assignment of physical
3 protection, appropriate to the consequences,
4 appropriate to the attractiveness and the use of this
5 material.

6 So I think I like that word "appropriate".

7 We have used the word "right-sizing" as opposed to
8 increasing or decreasing. It's not simply increasing
9 or decreasing. It's simply right-sizing, assigning
10 the protection that is appropriate for that material
11 and that category and that attractiveness level.

12 So I want to make sure that we understand
13 that this is a rulemaking that's going on in parallel.

14 Part of this rulemaking, in addition to the revision
15 in the categorization scheme, is to make generally
16 applicable the lessons learned of all of the orders
17 that we have put in place, particularly since 9/11.

18 So that is another major aspect of this
19 rulemaking, is that we have taken a lot of lessons
20 learned over the last several years in terms of the
21 orders that we have given to specific fuel cycle
22 licensees and generally to fuel cycle licensees that
23 we're going to be putting into the regulations.

24 MR. CAMERON: Okay. Thanks for that
25 clarification.

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1 Jim, you had your tent up.

2 DR. BRESEE: I think the comments I was
3 going to make would be better made at Albuquerque,
4 when we will have in hand a group of very well-
5 qualified analysts available.

6 But just as background, there has been
7 some very interesting and useful work done under the
8 Gen IV program, which is being done internationally,
9 under the general category of Proliferation Resistance
10 and Physical Protection, PR&PP.

11 A good deal of value in terms of analysis
12 can be obtained by recognizing that there's a
13 considerable difference in threats between non-country
14 and a sophisticated adversary. To a considerable
15 extent, the approaches taken are quite different.
16 Attractiveness in the old-fashioned term was aimed
17 more at delay in the process of achieving weapons-
18 attractive material as contrasted with elimination of
19 that type of approach.

20 Ed is completely correct. In a mixture of
21 uranium and plutonium, it is just a matter of time
22 associated with obtaining access to high enrichment
23 materials. The same thing can be said of a lot of
24 other mixtures.

25 But I think the details could be better

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1 examined in the Albuquerque meeting.

2 MR. CAMERON: Thank you, Jim.

3 Dan?

4 MR. STOUT: Just a little clarification or
5 background on the paper that Ed was referring to, the
6 Bathke, et al, study that Los Alamos led and the other
7 National Labs participated in.

8 That was done in the context of evaluating
9 the UREX process. When GNEP first rolled out, there
10 was a hope that a reprocessing technology could be
11 developed that would utilize the transuranic materials
12 by increasing the radioactive composition of the fuel
13 and, therefore, increase the time, as Jim was
14 referring to, and make that material less attractive.

15 Studies did conclude that elements like
16 neptunium and americium are still fissionable and,
17 therefore, the attractiveness of a plutonium
18 transuranic mixture, for example, is actually more
19 attractive than MOX, which would be like 95 percent
20 uranium and 5 percent plutonium.

21 MR. CAMERON: Okay. Steve, and let's go
22 to Marshall and then Arjun. Or Steve and then we'll
23 go to Arjun.

24 Steve?

25 MR. SCHILTHELM: Just a statement about,

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1 not to debate what Ed said, but my experience as a
2 licensee is that NRC is in a continual threat
3 evaluation mode. And the threat that they are
4 assessing and the requirements that they are placing
5 on licensees is not a static process. It is really
6 quite dynamic. If you are a licensee, you understand
7 just how dynamic it is, and I think Marshall could
8 probably tell you that that's not something that will
9 probably end or change. Post 9/11, we realized some
10 things, and it will remain a dynamic process, I
11 believe.

12 Kind of circling back to the regulatory
13 framework and the broader question, I think in the
14 last public meeting, and I don't recall exactly when
15 that was, but industry went on record as outlining our
16 priorities. And I don't think those priorities have
17 changed in this timing sequence of those things we
18 think are important from a regulatory framework
19 standpoint.

20 We talked at length about MOX
21 transportation and plutonium mixtures. We talked
22 about plutonium mixtures in a potential reprocessing
23 plant as being secondary, and then probably tertiary
24 is the more advanced separations. And I don't know
25 that those priorities have changed.

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1 Eric, you may have a slightly different
2 view on the advanced separations of neptunium and
3 americium, but we suggested to NRC that those things
4 could come along later, and by later, we mean years
5 later in the regulatory framework development.

6 MR. CAMERON: And that was sort of the
7 message you were giving in terms of the importance of
8 this gap being of moderate importance.

9 And then, we'll see if Eric wants to add
10 something here, but go ahead, Tom.

11 MR. HILTZ: Yes, I went back and looked,
12 and I apologize if there's some confusion about
13 diversion analysis and characterization.

14 We do have a gap that is risk-informing
15 Part 73 and Part 74 that is tied into the same
16 Commission direction that came down with the diversion
17 path analysis. That gap is designed and characterized
18 to perceive to reduce unnecessary regulatory burden.

19 I think the MOX transportation issue is
20 moving separately from the reprocessing framework
21 because there may be a need to implement that prior to
22 we revise our regulatory framework.

23 So I hope that context is helpful.

24 MR. CAMERON: And go ahead on a
25 clarification on that, Marshall, and then we will go

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1 to Eric.

2 MR. KOHEN: Right, and I will just say
3 that what Tom says is exactly right. We are planning
4 to do a relook at the transportation security aspects
5 of Part 73 in conjunction with the revision, the
6 rulemaking that we're doing on fixed sites. So that
7 is exactly right. So the transportation aspects will
8 be considered at the same time as the fixed site for
9 fuel cycle security.

10 MR. CAMERON: Okay, which is different
11 then this risk-informing. So, when you say the fixed
12 site, is that --

13 MR. KOHEN: It's part and parcel, at least
14 from the 73 perspective.

15 MR. CAMERON: Okay. Eric, a comment?

16 MR. LOEWEN: I disagree with Steve that
17 the advanced separation doesn't need to wait in the
18 regulatory process. So we are behind that technology-
19 neutral. The separation that is being done with the
20 pyro processing is being done today, Idaho National
21 Laboratory, in the treatment of ERB II fuel. There's
22 a record decision by the DOE. There's an EPA decision
23 there, and, also, you have the National Academy of
24 Sciences endorsing that technology.

25 So what we are trying to do is see that

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1 that technology gets treated equally on the regulatory
2 basis, like we do other sort of technologies as far as
3 enrichment or fuel manufacturing is technology-
4 neutral. You're not picking what needs to be done.

5 MR. CAMERON: Okay. Thank you.

6 Arjun?

7 DR. MAKHIJANI: I really recommend the
8 paper done, published by Brookhaven National Lab, to
9 Alex and Marshall, in 2009, Barry, et al. I will
10 supply you the reference.

11 But they looked at all the different
12 reprocessing technologies. They binned them in four
13 different groups. They found a number of findings,
14 but even for electrometallurgical processing, they
15 found proliferation advantages were not very
16 significant. And for states with knowledge of PUREX,
17 they were minimal. For non-stated actors, they were
18 modest.

19 And there were a number of National Lab
20 authors that participated in this, Brookhaven and Los
21 Alamos. Jim probably was referring to this kind of
22 set of studies that is being done by DOE. I think
23 there's been a good effort.

24 And I think you should really take this
25 particular effort and some other things done in the

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1 academic world in science and global security from
2 Princeton, Frank von Hippel and their associates. I
3 would be happy to supply you with the references.

4 But the idea that somehow that there's a
5 gradient attractiveness level, once you've gotten rid
6 of the fission products, is not very technically-
7 sound. Once you have separated the fission products,
8 the proliferation resistance is essentially gone, and
9 then we are arguing in the margins of what
10 proliferation resistance is.

11 And there is absolutely no technical basis
12 for creating some kind of a gradient unless you are
13 talking about a cliff, you know. When you add fission
14 products, it is a cliff. The rest is 2 percent, 3
15 percent.

16 MR. CAMERON: Okay. Thank you, Arjun.

17 And Alex?

18 MR. MURRAY: Thank you, Chip. You skipped
19 over me twice. I'm taking notes.

20 (Laughter.)

21 I heard a couple of things mentioned here
22 which are sort of I'll repeat my computer memory files
23 here. I have heard something about standards, spent
24 fuel standard, a cliff, leaving in some fission
25 products, et cetera.

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1 And I remember from centuries ago there
2 were discussions about spiking the fuel with either 1
3 percent of the fission products or cobalt-60 or
4 putting a cobalt-60 rod in with a MOX fuel assembly
5 prior to shipment.

6 And I was wondering, for the parties at
7 the table and in the audience, is that something that
8 should be revisited, reconsidered, reevaluated, or
9 should it just be left to history?

10 Thank you.

11 MR. CAMERON: How about MC&A? Do we need
12 to say anything about that? We haven't mentioned MC&A
13 at this point.

14 But before we go there, Dan, go ahead.
15 I'm sorry.

16 MR. STOUT: I think the NRC needs to
17 consider the hazards. Having radiation dose is one
18 factor that terrorists would consider. You know, they
19 may be willing to give up their life for their cause
20 of creating a detonation.

21 Other factors that should be considered
22 are the time delay, and going back to MOX fuel, it is
23 not a snap of the fingers to turn a fresh MOX assembly
24 into an improvised explosive device. You need to
25 assess these factors in the attractiveness of the

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1 material on balance, right-sizing. In a post-9/11
2 world, you need to consider the factors that cause
3 delay and those that don't.

4 So I would argue that what you just
5 proposed would not be an effective deterrent. It
6 would certainly increase safety risk at the
7 operational site, and it is not something that we
8 would support.

9 MR. CAMERON: And Ed?

10 DR. LYMAN: Actually, if there were a
11 separation process in which the weapons-usable
12 material was never separated from fission products, to
13 the extent that it always met the spent fuel standard,
14 that would be probably the only type of separations
15 that we would think have the potential for being
16 adequate to proliferation resistance.

17 But as Dan said, you are trading
18 proliferation resistance for significantly-increased
19 occupational risk and possibly public safety risk.
20 And you have to wonder, is that a fruitful way to go?

21 It certainly doesn't satisfy ALARA to say
22 that you want to have a process which you make as
23 hazardous to everyone involved as possible. So, from
24 a theoretical standpoint, we would say that could be
25 the only way that we would accept reprocessing. But

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1 from a practical standpoint, if you need that kind of
2 an approach to generate electricity, I mean you have
3 to wonder. It is definitely not the softest energy
4 path you can think of.

5 MR. CAMERON: Anybody want to follow up on
6 that? Eric, do you have anything, any comments?

7 Okay. How about MC&A?

8 And I think Arjun has a comment on MC&A.

9 DR. MAKHIJANI: Well, one thing that I
10 have looked at a fair amount that is a source of
11 concern that I alluded to earlier is MC&A should
12 include tracking of materials, nuclear materials and
13 waste, especially nuclear materials and waste.

14 I can assure you there's going to be a big
15 issue in the not-too-distant future. There's an
16 upcoming article in Science and Global Security
17 showing that there are considerable discrepancies
18 within the Department of Energy of nuclear weapons
19 materials.

20 I have myself written a report on
21 discrepancies in nuclear waste of 300 kilograms at Los
22 Alamos National Lab that, in my opinion, are still
23 unresolved. You can find it on our website. There's
24 other discrepancies that the Department of Energy
25 itself has written about in a 1996 memorandum that's

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1 publicly available.

2 I think this is a very neglected part of
3 nuclear materials accounting and possibly one of the
4 more vulnerable because we are talking about
5 diversion, something you referred to earlier, you
6 know, tracking.

7 It is relative easy, if you have an
8 inside/outside job, compared to other ways of
9 diversion, hiding things and saying they're in waste.

10 I mean this is potentially a pretty serious problem,
11 and there have been very large waste accounting issues
12 in the United States. I think we don't know of them
13 in other countries because they are not as open, you
14 know, don't have access to as many materials.

15 But we have certainly advocated much, much
16 more careful materials accounting and waste,
17 especially when processing of large amounts. And we
18 are talking potentially about processing a thousand
19 tons of plutonium here.

20 MR. CAMERON: Tom, is that the type of
21 issue that you are going to consider in the MC&A?

22 MR. PHAM: Thanks for your comment.

23 Regarding an NRC facility, we have pretty
24 strict requirements currently on monitoring and
25 controlling waste. For example, for a Cat 1 facility,

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1 we only allow the facility to process a certain
2 quantity of waste within six months with a limited
3 quantity.

4 And every type of material, including
5 waste shipped off site, must have a measured value.
6 So we have a good assurance for the facility to
7 maintain strict control of all types of material,
8 including waste.

9 And also, to elaborate a little bit more,
10 we are considering the diversion path analysis. That
11 is a way, a method, to look at MC&A combined with the
12 physical protection aspect, to look in different
13 diversion scenarios that the facility must face.

14 Similar in the safety, the facility looks
15 at different accident scenarios. In MC&A, the NRC
16 facility will look at different diversion scenarios,
17 material diversion scenarios, and come up with a
18 different scenario with different mitigating measures,
19 how to protect, deter and protect those scenarios.

20 That's what my thoughts are to help
21 clarify the issue on waste and the issue on the
22 diversion past analysis.

23 MR. CAMERON: Okay. Thank you, Tom.

24 Rod?

25 MR. McCULLUM: Yes, I just want to say

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1 that I agree that MC&A is a serious issue. I agree
2 that we need to be able to account for these materials
3 at every step of the way. Certainly, the vision that
4 I have for these types of technologies is that if they
5 are things that can make the world a safer place, they
6 need to be able to demonstrate that. They need to be
7 able to know that these are the materials we have and
8 we know where they are all the time, every one of the
9 materials.

10 And in being comprehensive in being able
11 to say that you are tracking all of the materials
12 every step of the way, I think therein is an
13 opportunity and a responsibility to be technology-
14 neutral, to write the regulations so that whatever
15 processes are to be used, that you can assure an
16 equivalent level of MC&A.

17 Again, getting to the discussion this
18 morning, you know, you write the regulations overall
19 to assure that. And to the extent more detail on a
20 given process is needed, perhaps guidance or perhaps
21 bifurcating a PWR/BWR sort of seems to be necessary.

22 But even-handed, technology-neutral, and
23 comprehensive materials control and accountability
24 requirements are what we need.

25 MR. CAMERON: All right. Ed, do you have

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1 another?

2 DR. LYMAN: I just thought of something.
3 Actually, this technology-neutral requirement could
4 really backfire on you, if you're not careful. Let's
5 say you had a technology-neutral limit, which you
6 already do have in the regulations, on the limit of
7 error on the inventory difference, as based on your
8 ability to measure the fissile material content in
9 process streams.

10 Some processes may be harder to meet that
11 than others. That would end up discriminating against
12 certain technologies, if you had a technology-neutral
13 limit.

14 So you should be careful what you wish
15 for.

16 MR. McCULLUM: I'll just say I'll go ahead
17 and wish for that because I think that any of these
18 technologies should be able to make the appropriate
19 measurements.

20 DR. LYMAN: Well, for instance, pyro
21 processing, there are going to be intrinsic
22 difficulties in measuring the fissile material content
23 in process streams. It will probably be harder than
24 it would be with a PUREX plant. So you are actually
25 going to impose a greater burden on one of your

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1 technologies than on the other.

2 MR. McCULLUM: Well, again, I think the
3 regulations should set the requirements, and it should
4 be up to the respective technologies to demonstrate,
5 to make the case as to how they meet that.

6 DR. LYMAN: So can we leave the existing
7 limit of their own inventory difference regulation in
8 place, since it's already technology-neutral?

9 MR. McCULLUM: I don't see why not. You
10 know, I'm looking at my various technologies around
11 the room, and it is a good place to start.

12 MR. CAMERON: And, Marshall, are you --
13 well, let's go to Steve first.

14 MR. SCHILTHELM: When we were working with
15 GNF, we did look at the issue of the existing
16 regulation in relation to IDs, and we were looking at
17 that time at aqueous processing.

18 There are challenges, and I'm sure Ed
19 didn't ask that question without reason. There are
20 challenges with the existing technologies and meeting
21 the existing IDs.

22 But, in all honesty, measurement
23 techniques and technology for making measurements are
24 evolving very rapidly. And the ability to measure
25 things is, things are being measured today that I

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1 would have never imagined could be measured five or
2 six years ago. I see Jim nodding over there.

3 So to conclude that the existing
4 requirements for ID measurement can or can't be
5 accomplished today I think is a little bit premature.

6 I think it is up to NRC to decide what is the
7 appropriate inventory, just IDs to be measured, and
8 then for industry to achieve that, because industry
9 has shown a lot of ability to adapt and come up with
10 ways to do things that need to be done.

11 MR. CAMERON: Ed?

12 DR. LYMAN: I would just like to read the
13 opinion -- this is a paper that was presented at the
14 ANS meeting in June. The authors were Lineberry, Bob
15 Benedict, and Zachary Miller from Idaho State
16 University.

17 So their statement was "The NRC
18 requirement" -- this is on SEID -- "will be impossible
19 to meet for any reprocessing technology and any plant
20 size. The NRC has neither licensed nor regulated
21 reprocessing facility in its 36-year history." Well,
22 that's not true.

23 "Its requirement for SEID, therefore, must
24 derive from fuel fabrication or enrichment plant
25 operations. When the time approaches for a U.S.

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1 reprocessing facility to be licensed by NRC, the
2 current standard must be revised."

3 That was their conclusion.

4 MR. CAMERON: Okay. Marshall, obviously,
5 these are not formal comments on a rulemaking that you
6 are doing, but I am sort of assuming that you are
7 going to take the transcript from this meeting and
8 everything you heard here, and that will at least
9 inform your decisionmaking in terms of putting
10 together a rule. Is that correct?

11 MR. KOHEN: Yes, sure. I mean, again, we
12 were charged by the Commission with doing extensive
13 public outreach, and I would say that's not just
14 domestic, international as well, because we know that
15 there are aspects of this that will have impact
16 internationally, that there are international groups
17 that are thinking about the types of things that we're
18 thinking about. And that's something the Commission
19 recognizes.

20 So, certainly, this is one of the first
21 opportunities for us to get some feedback. Obviously,
22 we haven't gone into too much depth about what we are
23 considering at this point, but we will be doing that,
24 certainly, in more detail as we can in the public
25 realm in the coming months.

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1 So the answer is yes, obviously.

2 MR. CAMERON: Okay, and one issue that
3 came up when we were talking about design basis
4 accidents, and we will get you out of here well in
5 time, but the issue of intentional malicious acts.
6 And one example was cyber security, and we had a
7 little bit of a discussion on that, but we thought
8 that we would save that for now to see if there were
9 any more comments on that.

10 And, Ed, I'm going to go to you. Do you
11 want to talk about cyber security here in this
12 context?

13 DR. LYMAN: Well, I'm not an expert in
14 computer engineering, but I did think of that in the
15 context of a more general design criterion that would
16 be essentially a safeguards-by-design rule, where the
17 design of any new facility that processes special
18 nuclear materials should have to go through an
19 iterative process to ensure that the design is
20 compatible with the safeguards and the material
21 control and accounting.

22 There is no such rule currently. And if
23 there were, certainly, cyber security would be one
24 aspect of that overarching safeguards-by-design rule.

25 MR. CAMERON: Okay. Ed, it seems that

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1 that could be part of what I am going to call the NMSS
2 rulemaking in terms of a Design Basic Criteria.

3 And I don't know, Marshall, if you have
4 anything you want to say about this, if you understand
5 the context that we are bringing up. Is that
6 something that is going to be addressed in any of the
7 risk-informing? I mean, how does your group get
8 involved in the cyber security as a design basis event
9 for any type of facility?

10 MR. KOHEN: To my knowledge, the only
11 cyber security regulations right now are for power
12 reactors. I don't know of any move to develop similar
13 regulations for fuel cycle facilities. I'm just not
14 aware of any. And thus, it would be sort of premature
15 for me to talk about what our role would be versus
16 anyone else's role in doing such a thing. So that is
17 pretty much where I can leave it.

18 MR. CAMERON: Okay, and the cyber security
19 for a reactor, those regulations may be much more
20 detailed than just the statement that this is a design
21 basis criterion that the license applicant has to take
22 account for. I don't know if that's true.

23 Alex?

24 MR. MURRAY: Thank you. I'm glad you
25 remembered I am here. I was getting worried there,

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1 Chip.

2 Just as a follow-up, Marshall, myself, and
3 others were just starting to look at an old proposed
4 Appendix Q to Part 50, which did discuss some General
5 Design Criteria for MC&A and safeguards. We are just
6 at a very preliminary level. There's some potential
7 attributes to it which would seem to still have some
8 relevance today.

9 As with all General Design Criteria, they
10 are at a top level. You know, the design shall
11 consider, the design shall have certain features for
12 physical protection, what have you, and guidance is
13 used to, if you will, expand upon what that means in
14 practical terms.

15 In the presentation this morning, there
16 was actually a reference, a Federal Register notice
17 reference to that proposed Appendix Q. Okay?

18 MR. CAMERON: Okay. Anybody have any
19 questions about this proposed Appendix Q? I mean, did
20 that sort of fly under the radar from the tee-up this
21 morning? Do people know what that is?

22 MR. McCULLUM: We were talking about it at
23 lunch, some of us. It is refocus. You alluded to an
24 Appendix P and an Appendix Q this morning. Are those
25 available on the web somewhere or are they on

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1 somebody's dusty shelf?

2 MR. MURRAY: The answer is, yes, they are
3 available on the web. You have to go into The Federal
4 Register notice files. We are going to see if we can
5 actually put some of these materials, including those
6 Federal Register notices, in a more direct link on the
7 NMSS web page.

8 MR. CAMERON: So it sounds like there is
9 an interest in this and the information should be more
10 accessible perhaps.

11 I think we are done with safety and
12 security, except that, as always, I would ask Miriam
13 to see if there's anybody who might have something to
14 say on this before we move on.

15 MR. PHAM: I would like to add some more,
16 based on the handout you have outside.

17 One of the other considerations of the NRC
18 to look into that is, in MC&A, to improve the material
19 accounting management for a reprocessing facility.
20 And of course, we already anticipate that a
21 reprocessing facility likely will have a very large
22 throughput and inventory. So we looked at that.

23 Last year many of our NRC staff present in
24 this room, we went to Japan and we visited Rokkasho
25 reprocessing. And there were some lessons learned,

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1 and we also exchanged some technical discussion with
2 the Japanese.

3 Actually, they have the facility running.

4 If they have trouble, they restart it, things like
5 that.

6 So, the MC&A part, we have a really good
7 discussion with them, and we learn about how they come
8 up with different new technologies, how to come up
9 with more real-time material management.

10 Right now, under our current Cat 1
11 facility, how we define, limit quantity for inventory
12 or for the SEID or things like that, we have a number,
13 and that number is pretty stringent. It's too strict.

14 And the Japanese shared their experience
15 with us, and they have actually a practical thing they
16 already completed and they already run it. And they
17 have a number to share with us.

18 So we consider all those things to make
19 sure that, if we need to license a reprocessing
20 facility, the nuclear material should be under a good
21 management program.

22 MS. JUCKETT: Any other comments?

23 (No response.)

24 Okay.

25 MR. CAMERON: Thanks, Miriam.

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1 We have been at it for about two hours.
2 Why don't we take a 15-minute-or-so break?

3 When we come back, we have a discussion of
4 environmental protection issues, effluent limits, 40
5 CFR 190, and other subjects that you might want to
6 weigh-in on, including perhaps what we might give more
7 attention to when we go out to the second workshop in
8 Albuquerque.

9 So it can be a pretty free-ranging
10 discussion, and I would anticipate that we would
11 probably wrap up around 4:30 at the latest, unless
12 there is a real burning discussion going on.

13 Okay. Thank you.

14 (Whereupon, the foregoing matter went off
15 the record at 3:13 p.m. and went back on the record at
16 3:39 p.m.)

17 MR. CAMERON: Okay, we have a topic which
18 is environmental protection. Originally, we were
19 thinking about effluents, effluent control and
20 monitoring.

21 We know, you all know probably, there's a
22 rulemaking that hasn't really started yet, except it's
23 in the information-gathering stage, to change the
24 basic radiation protection standards in Part 20. And
25 whatever comes out of that is going to apply to these

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1 types of facilities, I assume, or may apply.

2 There's the whole issue here of 40 CFR
3 Part 190, and we heard from Brian from EPA about they
4 are at very early stages. We are going to see if we
5 can get Brian and his colleagues to Albuquerque to be
6 at the table.

7 I'm looking for what else. Available
8 technologies for control of reprocessing effluents.
9 So this is the time to have some discussion of these
10 environmental issues.

11 Do we have a tee-up? We don't have a tee-
12 up? Oh, we do have a tee-up? It's not Alex again, is
13 it? Oh, my God.

14 (Laughter.)

15 MR. MURRAY: No, it is actually Alex's
16 twin brother Skippy.

17 MR. CAMERON: Skippy Murray? Okay.

18 MR. MURRAY: Yes.

19 MR. CAMERON: Okay. We're going to have a
20 tee-up by Skippy Murray, and he's the only one who
21 will be employed here after this.

22 (Laughter.)

23 MR. MURRAY: Okay. Let me just go
24 straight into it.

25 Next slide, please.

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1 Environmental protection has several
2 aspects involved. In this short presentation, we are
3 going to primarily focus on effluents and emissions,
4 which has been the main discussion of the Working
5 Group at the NRC.

6 Next slide, please.

7 Okay. A little bit about effluents and
8 emissions. These limits are actually established by
9 the EPA. The actual limits are 40 CFR 190. It is an
10 EPA regulation, for those not familiar with federal
11 regulations.

12 The NRC regulates to the EPA limits, and
13 we do that via 10 CFR Part 20, which basically are the
14 standards for radiological protection. They have dose
15 requirements, and so forth, in there.

16 Now 40 CFR 190 for emissions and effluents
17 has two aspects to it. It has dose limits and it has
18 quantitative limits. The dose limits are relatively
19 low. They are based upon individual health impacts.
20 Sometimes the determinant that is used is the MEI, the
21 Maximally-Exposed Individual. And I have shown the
22 limits there. They are essentially 25 millirem for
23 whole body TEDE dose. Okay?

24 I have just put in for comparison, for
25 members of the public, I put in there what some

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1 typical experiences with ionizing radiation exposure
2 correspond to. A typical chest x-ray is approximately
3 10 millirem. If one moves from the Washington, D.C.
4 area to the Denver area, and you live there for about
5 a year, the difference is about 200 millirem. So that
6 puts it in perspective. Again, these dose limits are
7 very, very low compared to natural variations in
8 background radiation.

9 The modern reprocessing facilities
10 overseas, based upon the reports the staff has seen,
11 some of the public meetings we have been in,
12 presentation to the Advisory Committees, have all
13 shown that these dose limits are easily met by modern
14 commercial reprocessing facilities.

15 Now the other attribute to this has to do
16 with quantity limits. And when I say quantity,
17 quantity when you deal with radiation, usually you
18 talk curie quantity. It is directly analogous to
19 mass. Okay?

20 These limits are a little more difficult
21 to understand, to ascertain, to meet. They are based,
22 instead of being based upon individual doses, they are
23 based upon collective doses, essentially, the whole
24 dose, the whole population of the world, and this
25 brings in this whole concept of micro-doses to macro-

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1 populations. Okay?

2 This may overstate the impacts. You know,
3 again, natural variations in background radioactivity
4 far exceed what we see here.

5 Next slide, please.

6 Okay. These are the actual limits. I put
7 the limit down -- the dose limits are in the table on
8 the lefthand side of the slide. The quantity limits
9 are on the righthand side.

10 The way the regulation is currently
11 written, the limits are in curies per, if you will,
12 electrical output, and it is phrased in gigawatt
13 electrical years. Okay? That is an output of
14 electrical energy, a big one, I might add.

15 Okay. In the last column of that table on
16 the right there, I have put in some of the values of
17 krypton, and I probably should say for the
18 radionuclides which were present when you have fuel
19 discharged at approximately, I think it's 52,000-
20 megawatt-days-per-ton burnup. So, roughly comparable
21 to what you have discharged from power reactors. They
22 may be just a smidge on the low side, but definitely
23 in the range.

24 And as you can see, for krypton and
25 iodine, there are some significant differences.

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1 In the case of the plutonium and other
2 alpha-emitting TRUs, the limit would appear to be
3 easily met by current filtration technologies.

4 Next slide, please.

5 Just a very quick discussion about the
6 basis for the EPA limits. As I said a moment ago,
7 these quantity limits are based upon collective dose,
8 population dose. In essence, the dose is spread over
9 the entire world's population.

10 It was based upon 1,000-gigawatt
11 electrical capacity of nuclear power. Let me just put
12 that in perspective. For those who are not familiar
13 with some of the terms, that is about 10 times what
14 actually exists today in the United States.

15 It was also predicated upon having a
16 reprocessing facility for, I think it was, every 14
17 nuclear power plants. And when you crunch the
18 numbers, that was about 25 reprocessing plants in the
19 United States alone. As I have noted on this slide,
20 the actual number today is zero.

21 It also was based upon short or relatively
22 short cooling times; i.e., reprocessing a short time
23 after discharge of the fuel from the reactor, somewhat
24 less than the current practice at La Hague and Thorp
25 at Sellafield, about four to five years of cooling.

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1 It was also based upon a generic site in
2 the middle of the United States. It would be a land-
3 locked site. And one of the differences with current
4 practice, that I should say Sellafield, La Hague, and
5 Rokkasho are actually on the coast of their respective
6 countries.

7 Next slide, please.

8 Now I should add this is sort of like one
9 of the laws of thermodynamics. Nothing comes easy.
10 There are control technologies available to capture
11 and reduce the emissions of some of the gases, such
12 as, I should say, krypton-85 and also iodine.

13 However, these control technologies do
14 introduce potential hazards. One of the things I put
15 up there is voloxidation. That is a process which has
16 been tested at the laboratory in a pilot plant stage
17 at Oak Ridge, if my memory is correct, which involves
18 heating up basically fuel, PWR fuel, that has been
19 chopped up in an oxygen environment. This forces the
20 release of materials. However, it does involve
21 heating potentially pyrophoric -- that means burning
22 or combustible materials -- up in an oxygen
23 atmosphere.

24 When you capture krypton and iodine and
25 tritium, what do you do with them? You have to store

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1 them and you have to dispose of them. Krypton, they
2 would have to capture as a compressed gas. Iodine
3 would be on some form of absorbents. These introduce
4 potential hazards. Do the benefits of capture
5 outweigh the risks of release?

6 Another interesting thing we found from
7 analysis, if one uses old-age spent nuclear fuel,
8 krypton and tritium decay considerably. They both
9 have half-lives of approximately 11 years. There's a
10 significant quantity of spent nuclear fuel older than
11 30 years. If you only reprocess 30-year-old fuel or
12 fuel older than 30 years, there's an automatic 90
13 percent reduction in your emissions or potential
14 emissions without even considering any capture
15 technology.

16 Having said that, I think it was Jim from
17 DOE who brought it up a little earlier on, you also
18 have a tradeoff. Okay? Yes, you can use aged fuel,
19 but then you lose some fuel value, the decay of the
20 plutonium-241. You also have some americium buildup
21 which can potentially impact recycle or disposal
22 considerations.

23 Again, nothing is easy. Whatever is
24 decided upon has to be based upon a very thoughtful
25 and thorough analysis.

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1 And one last result from our current
2 preliminary analyses that have been performed by the
3 staff is there are many assumptions, including
4 assumptions in the iodine analysis. Some of those
5 assumptions may not be valid today.

6 Next slide, please.

7 And again, just on this slide, are there
8 any specific requirements for reducing or addressing
9 emissions and effluents or protecting the environment
10 from potential reprocessing and recycling facilities
11 in the future? Some things are mentioned here.

12 Next slide, please.

13 And I have just put up some points here
14 for discussion in the short time that we have.

15 You know, again, I think that there could
16 be some very interesting discussions about age of the
17 fuel, any specific performance requirements, minimum
18 decontamination factors on effluents, et cetera.

19 I'm done.

20 MR. CAMERON: Thank you very much, Alex.

21 What's the controversy here? I mean,
22 what's the controversy for discussion in terms of
23 effluent limitations?

24 One statement you made is that it is going
25 to be fairly simple for reprocessing facilities to

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1 meet the NRC's effluent limits. Is that --

2 MR. MURRAY: I would characterize it this
3 way: the dose limits appear to be easily met. The
4 quantity limits would not likely be met using current
5 practices, not necessarily current technologies, but
6 using current practices.

7 So, for example, taking a La Hague
8 facility or a Sellafield Thorp facility or a Rokkasho
9 facility, and placing the equivalent in the United
10 States of America, it most likely would not meet the
11 quantity release limits, as with current practice.

12 MR. CAMERON: So we would have to use
13 different practices? And by practices, you mean --
14 some examples of a practice, for example?

15 MR. MURRAY: Some examples of potential
16 practices would be use of captured technologies. Say
17 for krypton, it could be some form of carbon or
18 cryogenic separation and absorption. In the case of
19 iodine, it could be improved silver impregnated
20 zeolites. In the case of tritium, it could be the use
21 of some form of noble metal catalysis or hydrating
22 materials, et cetera.

23 But the key thing is not currently
24 practiced. It's a delta.

25 MR. CAMERON: Okay. Good.

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1 Rod, go ahead.

2 MR. McCULLUM: Yes, I want to, first of
3 all, correct something Alex said. I don't think our
4 licensees ever consider meeting NRC's requirements
5 easy.

6 (Laughter.)

7 But I do agree that recycling facilities
8 should be able to rigorously demonstrate compliance
9 with those effluent limits. Nor should it be easy, I
10 would point out.

11 I think this was a good presentation in
12 that it demonstrates you are looking at all the right
13 things. We would certainly want to make sure that
14 your requirements are up-to-date with the latest
15 radiation protection science.

16 We understand that EPA is looking at 40
17 CFR 190 consistent with the 10 CFR Part 20. And in
18 that context, I don't know that there is a lot
19 specifically to be said here for the recycling
20 regulation, other than that we would hope these things
21 would all be harmonized and that you folks would come
22 into line with that.

23 There's a couple of things on that slide
24 or were mentioned in your presentation. They are in
25 the penultimate bullet. Spent nuclear fuel time,

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1 aging, or other requirements, I mean recognizing that
2 you do lose some of the bad actors if you age it, and
3 then, of course, you also take on the challenges of
4 americium. That is not something, I don't think, our
5 licensees or applicants would want to see specified by
6 regulation in terms of seeing a regulatory requirement
7 that you could only reprocess fuel of a certain age or
8 not of a certain age.

9 I think that's something that, if an
10 applicant determined in their process to meet a limit
11 they had to have fuel of a certain age, they would
12 commit to that as a license condition or a technical
13 specification, but that would really be up to the
14 licensee to propose those kinds of limits. Those are
15 not in a -- sorry -- risk-informed, performance-based,
16 technology-neutral regulation. That is not the kind
17 of thing you would specify; it would not be productive
18 to specify it by regulation.

19 And similarly on siting attributes, I
20 would not want to see, you know, us having to take
21 credit for being on the coast to site one of these
22 facilities. You may very well site one in an arid or
23 a humid part of the United States far away from the
24 coast. So, again, it would be up to the licensee to
25 demonstrate how they comply with the environment in

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1 which they choose to site themselves.

2 But, really, looking at this presentation,
3 you have got the right things on your plate. And we
4 encourage all the agencies looking at these things to
5 harmonize these regulations and to come up with a
6 workable approach.

7 MR. CAMERON: Thanks, Rod.

8 Steve?

9 MR. SCHILTHELM: If you could scroll back
10 to the slide that shows the actual limits? One more.

11 I'm sorry, go forward. Yes.

12 If you just look at the limit and imagine
13 trying to comply with a limit that says I can release
14 50,000 curies, I believe that is, per gigawatt
15 electric year, in typical regulation you would have a
16 dose-based standard. Well, you know, not to pick on
17 EPA, they came up with a criteria based on the
18 expected technology, the expected number of
19 reprocessing plants, the expected number of nuclear
20 power plants, and the expected ability to either
21 capture or not capture some of those radionuclides.

22 But that particular value doesn't really
23 correspond to a dose or a risk or a detriment to the
24 public. I think that is where the difficulty lies.

25 The denominator changes over time. We

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1 have even had debates about, what is the denominator?

2 Is it the gigawatts electric produced from the MOX
3 fuel that you create or is it the total gigawatts
4 electric produced in the United States? Different
5 people choose what the denominator should be based
6 upon their understanding of the background.

7 So I think the difficulty is, one, the way
8 the metric is written, and then, two, the science
9 behind the metric. Radiation protection regulations
10 and dose modeling have evolved, I believe, three times
11 since this regulation was written. So, to state it in
12 terms of curies released rather than a dose metric,
13 this is very problematic.

14 I have no preconceived notion of what that
15 would mean if you applied today's technology and
16 today's dose models and today's attributes, but I
17 would suggest that a standard should be dose-based,
18 not curie-released-based per gigawatt electric.

19 MR. CAMERON: Okay. Thanks, Steve.

20 You know, both you and Rod have expressed
21 some concerns, that, for example, don't establish
22 generic limits on things like fuel age or siting.
23 Where's the playing field for effluent limits and
24 application of existing effluent limits to
25 reprocessing facilities? The playing field for that

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1 is existing Part 20, existing 40 CFR 190, or any
2 changes that the NRC proposes as part of this Part 20
3 rulemaking or what EPA might propose as part of CFR
4 190? I mean, is that where this discussion is really
5 going to center, as opposed to this rulemaking --

6 MR. McCULLUM: Yes, that is why I said
7 there is -- and I am glad Steve brought it back to the
8 point because, in visiting that playing field, that
9 certainly is an issue. I agree wholeheartedly, I think
10 everybody in the industry agrees that dose-based is
11 the way to go.

12 But that is a much broader subject than
13 recycling regulations. It is a subject that needs to
14 be addressed, and I am encouraged to hear from EPA
15 that they are working on it, and NRC is also working
16 on it on a broader level.

17 And we would just hope that that whole
18 playing field would be harmonized and conform to the
19 latest technical understanding of what the appropriate
20 radiation protection standard should be. Then we
21 will, in our usual, rigorous way, we will look at
22 those standards.

23 MR. CAMERON: Tom?

24 MR. HILTZ: I think our understanding of
25 40 CFR 190, in our communications with the Commission,

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1 we have indicated that we recognize that 40 CFR Part
2 190 is a potential challenge for a reprocessing
3 facility to meet. But we have not identified that as
4 one of our regulatory gaps.

5 It is my understanding that our
6 regulations in Part 20 embed compliance with 40 CFR
7 190. But the staff, up until now, has taken a
8 position where we will work collaboratively with the
9 stakeholders, including EPA, to understand, help
10 understand their concerns, be a resource, if the
11 decision is made to revise 40 CFR Part 190, and
12 progress the discussion appropriately. But we are not
13 the lead for 40 CFR Part 190.

14 MR. CAMERON: Would it be helpful in
15 Albuquerque at least to have further discussion, if we
16 had Don Cool or someone like that or EPA at the table,
17 to have a discussion of this? I'm just trying to get
18 an idea of where the productive discussion on this
19 issue could be.

20 Let's go to Rod and then Phil.

21 MR. McCULLUM: I would just say we would
22 certainly welcome that. If the parties that are
23 involved in those areas are at the table, the
24 opportunity to discuss the issue would be valuable.

25 MR. CAMERON: Okay. So not just EPA, but

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1 maybe the people who are working on the radiation
2 protection standards, I guess.

3 MR. HILTZ: Yes, I think we will need to
4 look at that --

5 MR. CAMERON: Okay.

6 MR. HILTZ: -- and figure out what we want
7 to accomplish in Albuquerque. And I certainly, you
8 know, want to make sure that our workshop is focused
9 on the gaps that we need to resolve.

10 MR. CAMERON: Right.

11 MR. HILTZ: And if EPA is willing to come
12 to the table and sit, we would certainly invite them
13 to do that and participate in the discussion.

14 MR. CAMERON: Okay. Phil?

15 MR. REED: Yes, I would just like to
16 follow up with what Tom says. Both of the EPA
17 regulations are enforced through our Part 20, which
18 requires both the NRC Part 20 regulations to be met as
19 well as 40 CFR 190. They are essentially enforced
20 through the ALARA concept, which is coming into the
21 tech specs under Appendix I of Part 50.

22 Now when you apply the ALARA concept, it
23 just simply means that, based on \$1,000 per person
24 rem, you just have a technology. You apply the
25 technology, and eventually you bring down the

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1 limitations.

2 But, as Alex had mentioned, sometimes a
3 technology may not be appropriate or it may not work
4 in these cases. But, then, you have going for it, you
5 have krypton-85 and tritium. Of course, you have
6 about 10-year half-lives.

7 And I'm not sure whether they are
8 mentioned in the low-level waste Part 61 or not, but
9 if they aren't, you can classify them as Class A, put
10 them under Class A, let them decay for 10 years.

11 But the basic concept here is, under the
12 ALARA, the industry is required to fulfill the ALARA
13 requirements simply by adding more technology in order
14 to reduce the effluents to the lowest limit that is
15 reasonably achievable.

16 MR. CAMERON: Thanks, Phil.

17 And Ed?

18 DR. LYMAN: Yes, that's a useful way to
19 look at it. I just wanted to point out, what is the
20 logic? The underlying logic here is that you are
21 taking spent fuel and you are processing it, and you
22 are releasing fission products in the process.

23 So it is incumbent upon anyone who is
24 operating such a facility to ensure that you do not
25 have a significant impact on the public. And for that

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1 reason, it is reasonable to impose the limits on
2 certain radionuclides, even if the individual doses
3 are shown to be low, because they do have collective
4 impacts.

5 Krypton-85 is unusual in that it does
6 disperse uniformly in the atmosphere. I think it will
7 eventually disperse throughout the entire hemisphere.
8 So it does actually impose a global burden.

9 And there are methods -- I think UNSCEAR
10 evaluated the collective dose impacts from
11 reprocessing using a model, and I don't think modeling
12 something like krypton, I don't think there's been any
13 real improvement because of the way it behaves. So I
14 am not sure there would be much benefit to be gained
15 from trying to look at that again.

16 But we do strongly support that, if there
17 is going to be reprocessing, that there needs to be
18 assurance that you do not release quantities of
19 radioactive materials into the atmosphere.

20 There are also other isotopes. As
21 mentioned before, carbon-14, I think one thing that
22 UNSCEAR found was that carbon-14 emissions actually
23 are significant contributors to the collective dose.

24 And Thorp actually did apply controls to
25 capture carbon-14. La Hague doesn't. But certainly

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1 in any revision of EPA regulations we need to take a
2 look at carbon-14 as well as any other isotopes which
3 in the intervening time have been shown to be
4 significant.

5 MR. CAMERON: Okay. Thank you, Ed.

6 And Arjun?

7 DR. MAKHIJANI: Yes, I think tritium and
8 carbon-14 were discussed earlier. I think the thing
9 that is different about reprocessing, as Ed said, you
10 are deliberately releasing fission products and
11 activation products. In a reactor, you try not to
12 release anything. And here, by the inherent nature of
13 a process, you are taking stuff that you would
14 otherwise be containing and releasing it.

15 So I think it is important to keep a
16 population dose concept in here. I mean, when we
17 calculate doses from atmospheric testing, we know that
18 carbon-14 is the most important component.

19 And I would just like to suggest to Alex
20 that a comparison with natural background and
21 radiation natural background for involuntary dose
22 imposition is not appropriate.

23 And the other thing that is not generally
24 taken into account -- and I have asked the National
25 Academy and repeatedly other agencies to think about

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1 this, EPA -- is very often you say, well, there's a de
2 minimis dose. You know, if it is a microrem or a
3 millirem, it's very small and you don't know its
4 effects.

5 But this is not correct because, if you
6 think about the idea that the linear threshold we
7 don't know; there may be a threshold of 1 millirem or
8 1 microrem. However, we get natural background of 7
9 rem per year, even if you live at sea level.

10 So, when you are imposing a dose on
11 somebody, it's not the dose, the millirem above zero.

12 It is the millirem above a level that we know that
13 Mother Nature is already doing to us. And we allow
14 Mother Nature and our dentist to do things to us that
15 we wouldn't allow our neighbor to do to us.

16 And so I think you cannot disregard when
17 you know that population doses are going to be very
18 large, which is a different situation from reactors,
19 actually. Reactors, you are not releasing large
20 amounts of materials, and in reprocessing plants you
21 are going to be releasing a million curies of tritium
22 every year whose dilution volume, to my back-of-the-
23 envelope calculation, to the existing drinking water
24 standards is 50 trillion liters per year.

25 That is a very large dilution model, and

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1 you don't want to approach 20,000 picocuries per year.

2 So, actually, the coastal versus inland is very
3 important in how you are going to consider your siting
4 and whether you can actually meet some environmental
5 limits.

6 My final point is that, you know, it is
7 very difficult maybe to think about gaseous emissions
8 in this way, but effluent discharges via pipes that
9 are comparable in concentration to Class A waste
10 should be considered similar to Class A waste. And
11 the legalistic idea that it is not waste until it is
12 on the way to the disposal facility should be
13 discarded.

14 Anyway, I would also look prospectively
15 ahead. If you want certainty that you won't be
16 disrupted by changes in regulations, I think some of
17 us have said that plutonium limits should be .15
18 picocuries per liter; tritium should be 400 picocuries
19 per liter.

20 And it's not just us on the outside. The
21 Department of Energy agreed in the cleanup of Rocky
22 Flats that plutonium should be .15 picocuries during
23 the decommissioning in surface water, not even
24 drinking water, surface water; that in licensing there
25 should be some kind of, at least the industry should

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1 consider some kind of proactive idea as part of ALARA.

2 Even if you are dealing with drinking water limits
3 the way they are today, maybe we should look to some
4 kind of guidance beyond drinking water limits for
5 thinking about ALARA.

6 I like the concept of ALARA, but I'm not
7 very happy in the way that it is applied to reactors
8 currently. And you wouldn't have as many scandals if
9 you were looking at, for instance, the individual
10 radionuclides that were being released. I'm referring
11 to the tritium scandals.

12 And we have not met with any success with
13 asking the NRC to think about individual radionuclide
14 releases from reactors. This problem is going to
15 become very magnified with reprocessing plants.

16 And I think when facilities are built, I
17 don't want a reprocessing plant to be built mainly for
18 non-proliferation reasons. But if they're built, I
19 think you want to avoid just discharging scandals to
20 the extent possible.

21 MR. CAMERON: Thank you, Arjun.

22 Rod and then Jim.

23 MR. McCULLUM: Yes. Again, getting back
24 to the spirit -- and I hope I can do this -- of our
25 earlier discussion, I want to agree with Arjun that we

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1 absolutely believe that we should protect the public
2 from the effects of the isotopes listed up there. So
3 we're in agreement there.

4 And we believe that we should protect them
5 in the accordance with the most up-to-date radiation
6 science information available.

7 And looking at what's under the middle
8 column limit there, it is simply our position that
9 does not represent the latest radiation science
10 information available. This is broader than -- again,
11 it would be useful to hear from the broader community
12 here because that is where we would like this to go.

13 And in that context, absolutely, we should
14 limit these releases with the most appropriate
15 standards, and we should apply ALARA. I don't think
16 any prospective applicant would see whatever dose
17 limits, if those are the most appropriate limits, as
18 we believe, as, okay, well, we'll release that much.
19 They would, then, look at the cost/benefits of going
20 below that, in accordance with ALARA requirements.

21 So we are in agreement of the need to
22 protect, and we want to do it with the most up-to-date
23 and informed radiation science.

24 MR. CAMERON: All right. Then Jim?

25 DR. BRESEE: Yes, let me just add a few

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1 comments with regard to krypton-85. I said some
2 things about it earlier today.

3 I think it is a little misleading to speak
4 of reprocessing automatically in some sense releasing
5 large quantities of krypton-85. There may be business
6 reasons not to, quite independent of the requirements
7 of whatever revised provisions may come from EPA or
8 NRC.

9 It turns out that more than 10 times the
10 quantity of xenon is accompanying the krypton in used
11 fuel. And xenon is a very valuable commodity. It is
12 non-radioactive. It sells for \$10 a liter, standard
13 temperature and pressure today. You might want to
14 recover krypton and xenon quantitatively simply to
15 balance the cost of reprocessing.

16 So, in addition to the need to meet
17 standards, one needs to look very broadly at future
18 fuel cycles. We have an opportunity, because of
19 delayed implementation in this country, to use our
20 quite advanced technology. Technology is evolving
21 rapidly.

22 And I'm personally quite optimistic that
23 we will be able to meet whatever standards are finally
24 established and not just say that, in some sense,
25 there's an automatic release associated with fuel

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1 reprocessing. Fuel reprocessing can be done very
2 cleanly. There will be ways in which it may
3 ultimately be seen as a way to reduce the threat of
4 proliferation rather than to expand it.

5 MR. CAMERON: Thank you very much, Jim.

6 Ed?

7 DR. LYMAN: Just looking at experience, no
8 reprocessing plant in the world actually captures
9 krypton. I know I looked at the original Thorp
10 assessment, and they decided that the cost wasn't
11 worth the benefit. And these are the same vendors in
12 some cases that are trying to build a plant here.

13 So the question is, how do we ensure that
14 the practices actually do improve if a plant is built
15 in this country? And if there is an effort to weaken
16 the EPA requirements because of the fact that plants
17 would have to do something different in the United
18 States than they currently do overseas, then that's a
19 problem.

20 MR. CAMERON: And Rod?

21 MR. McCULLUM: Yes, and I think I would in
22 part agree with that. I think there will be an
23 expectation that plants here do something different
24 than what they do overseas.

25 I think that, again, the limits we are

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1 looking at there are not necessarily the appropriate
2 driver for that expectation, but, clearly, we are not
3 talking about weakening regulations here. We are
4 talking about making the appropriate regulations
5 consistent with the latest available radiation
6 science.

7 MR. CAMERON: Okay. Anybody have a
8 comment on that? I think that was an important point,
9 if it wasn't understood before, that from the
10 perspective of the industry, you are not thinking
11 about trying to see that regulations in this country
12 are going to be weakened to correspond to regulations
13 elsewhere.

14 MR. McCULLUM: Yes, to put it more
15 succinctly, we are not just simply going to Xerox the
16 blueprints of La Hague and Thorp and bring them over
17 here.

18 MR. CAMERON: Okay. An important point.

19 Yes, John?

20 DR. FLACK: I think the issue is going to
21 come down to, unfortunately, collective dose. That is
22 where folks are going to have to come to grips with
23 this, you know, how one perceives that issue.

24 Now it may be on the EPA's plate right
25 now, and that may be how they decide on what

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1 quantities are acceptable, and then we will have to
2 enforce it. But this still has to be determined, and
3 there should be a technical basis for it.

4 You know, ALARA would say that, if we are
5 talking about a collective dose, what's acceptable? I
6 mean you just keep pushing the technology until it's
7 no longer available.

8 There has to be some tradeoff there with
9 that, but I don't think this whole issue has played
10 out yet. And I think this is going to be something
11 that is going to be a concern on everybody's mind
12 going into this, as to how we deal with that gorilla
13 in the room kind of thing.

14 Maybe things have changed since I have
15 looked at this last, but if it hasn't, it looks like
16 there is still a gorilla in the room on this one.

17 MR. McCULLUM: Yes, Chip, I want to agree
18 with that. And again, I stress that's why we think
19 the broader dialog is necessary here.

20 MR. CAMERON: Okay. Sven?

21 DR. BADER: Yes, we're not skirting the
22 issue. We're not trying to suggest levels need to
23 come down.

24 I think there's been points here that
25 tritium is missing, carbon-14 is missing. What we are

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1 really emphasizing is we are looking for a sound
2 technical basis for an updated regulation, so that we
3 have something to design to.

4 MR. CAMERON: Okay. And I think if
5 there's one point that is important that is coming out
6 of this discussion, it is that, what you said, what
7 Sven said.

8 Do people agree with John that there is a
9 gorilla in the room? Is that the right
10 characterization?

11 MR. McCULLUM: Various forms of primates,
12 I think, yes.

13 (Laughter.)

14 MR. CAMERON: Various forms of primates,
15 okay.

16 All right. Steve?

17 MR. SCHILTHELM: To John's point about a
18 gorilla in the room, there is. ICRP has written
19 differently about collective dose than they did in the
20 past, if you look at their new recommendations. Some
21 agree; some disagree.

22 So I think there is a debate that will
23 occur, as Rod said, in a different forum, and NRC and
24 EPA are going to have to come through that debate and
25 put forth regulations.

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1 So, yes, you're exactly right.

2 MR. CAMERON: Okay. Yes, Arjun?

3 DR. MAKHIJANI: One brief thing that
4 hasn't come up, you know, in the last century, the
5 idea of regulation or protection of health and
6 environment was around human beings, various primates.

7 But in recent times, the ICRP and in the United
8 States various bodies have taken up the question of
9 ecosystem risk, and it is no longer accepted.

10 DOE has begun to grapple with this. We
11 don't agree with the details of what the DOE is doing,
12 but we agree that the topic is very important.

13 At my little institute, we have begun to
14 kind of think through this problem as systematically
15 as we can.

16 And I think when you look at these
17 discharge levels, population dose is not the only
18 consideration in mind. And I do think, you know, we
19 are going to do something, and I do agree with the
20 idea that there should be some -- that business should
21 have some environment in which they can make an
22 investment. It is not an investment that I support,
23 but if you are going to do it, there shouldn't be
24 turbulence.

25 Okay. To accomplish that right, I think

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1 you need to be stringent and prospective in what the
2 public might want in terms of health and environmental
3 protection. I don't have any specifics to suggest at
4 this time. I probably will a few months down the
5 line. But we are looking at this in relation to
6 Hanford, for instance.

7 And I think it would be good to put
8 ecosystem risk on your plate in this regard,
9 especially in regard to putting limits on total
10 discharges.

11 MR. CAMERON: Sven?

12 DR. BADER: I just want to point out that
13 Sandia just issued a report on providing a technical
14 basis for 40 CFR 190, and it's worth looking at that.

15 They looked at the cow uptake, and so forth, yes.

16 MR. CAMERON: Okay. Jim, do you have a
17 tent up from before or do you have something to add
18 now? Okay. All right, I just wanted to make sure.

19 But are there any other environmental
20 issues someone wants to bring up? Are there any other
21 issues that we haven't touched on at all today that
22 are important?

23 (No response.)

24 Any suggestions for Albuquerque? I mean
25 we have already discussed among the NRC staff what we

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1 might do differently, more focus on certain things.
2 But this is the time to address anything like that.

3 Rod?

4 MR. McCULLUM: Yes, just very simply, I
5 think the NRC staff has heard a number of challenges
6 put to it, both from the industry side and from some
7 of the other stakeholders here.

8 The tee-up presentations are a great idea.
9 Maybe if we could see in a month from now some
10 reaction to some of the challenges that you heard
11 here, which I think if you tee that up, might further
12 the dialog.

13 MR. CAMERON: So tee-up some of the
14 challenges that we have heard?

15 MR. McCULLUM: Yes. I think you heard a
16 lot from industry as to some of the things we would
17 like to say. And if you didn't, I will say it again:
18 risk-informed, performance-based, technology-neutral.
19 And I think, also, from our stakeholders here you
20 heard some of their concerns.

21 I think to the extent that in your process
22 so far you have been thinking about these things,
23 something that illuminates what you have been thinking
24 so far. A slide that says, hey, here's what we heard
25 from you guys, and here's where we're looking at

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1 addressing it. And that might stimulate some
2 additional dialog.

3 MR. CAMERON: Now that's a good
4 suggestion. I'm not sure where the staff will want to
5 go at that point in terms of how their thinking has
6 changed or not changed.

7 But, you know, it is always difficult when
8 you do two or more of these workshops. We want to
9 give the people who are around the table in
10 Albuquerque a chance to talk about this as if it is
11 fresh and new, but there is still a value, as you
12 point out, to teeing-up, well, here's some of the
13 challenges that we heard.

14 Different people around the table, or even
15 the same people from reflecting on things, might have
16 a different take on it then. But I think that is a
17 good idea.

18 MR. McCULLUM: Yes, and for our part, I
19 think our thinking has evolved through this day and a
20 half. And we really appreciate that. We have been
21 talking amongst ourselves.

22 I am not expecting you will have all the
23 answers. When I say tee-up, here's what you heard and
24 here's where you think you're going with it; it might
25 be you plan to address it, not that in a month from

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1 now you will have the regulation ready.

2 MR. CAMERON: Okay. Thank you. Good
3 comment.

4 And I think we have already talked a
5 little bit on the staff level about, well, first of
6 all, we are going to make the tee-ups available
7 beforehand, so that people have those.

8 And also, perhaps take a look at the
9 discussion points and make them more focused perhaps
10 on one or two points, so that we can really zero-in on
11 what we have found to be the most valuable here.

12 But that is a good suggestion. Thank you.

13 Sven?

14 DR. BADER: I actually have a question for
15 Alex. He quoted something that said there are some
16 iodine-129 assumptions that are not valid today.
17 Could you elaborate on that?

18 MR. MURRAY: Oh, yes. This is in the
19 analysis which the staff has been looking at and
20 considering. Some of the iodine, the assumptions for
21 the iodine doses were based on, first, some different
22 versions of the ICRP, different dose assessment
23 methodology, but also some assumptions about where, if
24 you will, where the points for ingestion would be.
25 Okay? What population would be impacted? Basically,

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1 a 50-mile population initially, then national dose,
2 and then, basically, a world dose, et cetera.

3 So some of it is locative and origin, and
4 some of it is basically the population assumptions in
5 growth. Some of those don't appear to be fully valid.

6 Okay?

7 I should on that, if those effects were
8 included, they would decrease -- iodine capture would
9 still be required, but the required amount of capture,
10 the decontamination factor, if you will, necessary to
11 meet the regulation would be reduced.

12 MR. CAMERON: Okay. Thanks, Alex.

13 Apropos of Rod's remark about this has
14 stimulated some of their thinking, I think everyone is
15 going to look forward to some of your developing
16 thoughts on the issue of risk that we talked about
17 yesterday and that document that you are coming
18 forward with, and perhaps having a discussion of that
19 at some point.

20 But I think Tom and others would be
21 looking forward to how your thinking has developed on
22 a lot of these issues by the time we get to
23 Albuquerque.

24 MR. McCULLUM: Yes, I am hoping we will
25 have our risk White Paper out and to that workshop.

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1 We would certainly be happy to discuss our thinking.
2 Either we will have it out or we will have evolved our
3 thinking to the point where we just have a few more
4 questions to address, and it might be useful to
5 discuss those. So, yes.

6 MR. CAMERON: Good. Good. That will be
7 great to have on the agenda.

8 And, Tom, did you want to say anything
9 else on these issues in terms of what the industry is
10 thinking?

11 MR. HILTZ: Well, I think it is helpful to
12 understand just what you indicated, that maybe we
13 could have some further evolution of the NRC thinking.

14 I think we heard from several
15 stakeholders. And if there are some important points
16 that we need to consider that you have gathered from
17 this, I think we would certainly like to hear those
18 and see those shared, if you want to provide them in
19 writing or be prepared in Albuquerque. I think that
20 would be very helpful.

21 MR. CAMERON: Okay. Great. So I think
22 that this meeting discussion will move us forward to a
23 different level in Albuquerque while still allowing
24 the same foundation issues to be addressed.

25 Go ahead, Dan.

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1 MR. STOUT: I just want to compliment you.
2 I think this process has been valuable. I think it
3 resulted in a lot of tough issues getting conversed
4 and getting views on the table that I haven't seen in
5 other formats.

6 You know, industry needs regulatory
7 predictability. From our perspective, it would be
8 great to have regulations done before we start design.
9 That isn't going to happen.

10 The NRC would love to have all kinds of
11 designs to look at and to make sure that the
12 regulations they put in place cover everything. And
13 that is not going to happen.

14 It is going to be an iterative process.
15 Like Marissa mentioned, you know, there's going to be
16 Reg Guides. I just think that collectively we need to
17 look at this whole thing as an iterative process, and
18 I implore you to continue to push forward.

19 It's the right thing to do from all
20 angles, for the NRC to strive to put in place
21 regulations, to get what you can from us, the
22 industry, and from stakeholders. And we encourage you
23 to just keep going.

24 Despite what's going on in the political
25 world, despite what's going on technically, this is

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1 the right thing to do, to enable a sustainable nuclear
2 industry long-term.

3 MR. CAMERON: And that's Dan with TVA, no
4 longer with DOE.

5 Okay. Marissa?

6 MS. BAILEY: Just to respond to what you
7 said, Dan, and to add onto Tom's comments.

8 First of all, I would like to emphasize
9 that the NRC doesn't take a position pro or con,
10 either for or against reprocessing. That is going to
11 be decided in the national dialog on how we eventually
12 manage our spent fuel.

13 Our role is basically to ensure that there
14 is a stable regulatory framework for us to be able to
15 license a reprocessing facility safely and securely if
16 an application comes in.

17 Having said that, our goal in this meeting
18 and in further interactions really is to about a year
19 from now produce a regulatory basis for rulemaking for
20 reprocessing, at least a draft regulatory basis. And
21 I think that that's what we are trying to drive
22 towards, is that in about a year we have a draft
23 technical basis or regulatory basis for reprocessing.

24 And so what we are trying to do here and
25 in Albuquerque, and maybe in other subsequent

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1 interactions, is to inform our decisionmaking. So I
2 do appreciate the comments and the feedback that we
3 have gotten from the various stakeholders.

4 I would encourage you to let us know if
5 there are some points that we aren't considering, but,
6 again, it's the regulatory basis for reprocessing that
7 we are trying to produce a year from now that
8 addresses at least the high-priority gaps and maybe
9 some of the medium-priority gaps.

10 MR. CAMERON: Okay. Thanks, Marissa.

11 And I always like to ask Miriam to go out
12 to the public because I don't really like to deal with
13 all the angry people out there. So I dish that off to
14 her.

15 MS. JUCKETT: There has not been enough
16 anger. Anyone have any comment? You have a captive
17 audience.

18 Cathy's angry.

19 (Laughter.)

20 MS. HANEY: No, Cathy is not angry. I
21 just thought, as long as you are offering the
22 microphone, I just wanted to echo Marissa's last
23 statements. I have found this very valuable. I have
24 been able to sit through maybe half of the meeting,
25 but I really think that I have benefitted as well as

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1 the staff from the open dialog, getting some of the
2 issues on the table.

3 So I appreciate you all taking the time
4 and effort to come to this meeting and contribute, and
5 we look forward to just future dialogs with you.

6 So, I'm sorry, Miriam, it wasn't angry,
7 but there you go.

8 MS. JUCKETT: Any other comments?

9 (No response.)

10 Sorry, Chip.

11 MR. CAMERON: Thank you, Miriam.

12 Tom, did you want to say any last things
13 to us?

14 MR. HILTZ: Yes. Thanks, Chip.

15 I want to associate myself with Cathy and
16 Marissa in thanking you all for participating. It has
17 been very helpful for us.

18 You know, we went into the workshop not
19 sure what to expect. And I think after two days, we
20 are very appreciative and we found it very, very
21 productive.

22 So thank you all for your participation.

23 I also want to thank the Working Group
24 members. Many of those are here, the NRC Working
25 Group who have provided support for this workshop, and

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1 I particularly recognize Jose and Jeannette for their
2 coordination efforts and support, and Alex who stepped
3 in the past couple of months to help pull some of the
4 presentations together. So thank you very much.

5 And finally, Chip, I would like to thank
6 you and Miriam for your outstanding support of the
7 workshop. It is a success because of you all in
8 principle. So thank you very much.

9 MR. CAMERON: Thank you all.

10 We are adjourned.

11 (Whereupon, at 4:39 p.m., the proceedings
12 in the above-entitled matter were adjourned.)
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