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NUCLEAR REGULATORY COMMISSION

Title: Toshiba's Request for Pre-application Review
of the Super-Safe, Small, and Simple (4s)
Reactor Design: Public Meeting

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U.S. NUCLEAR REGULATORY COMMISSION

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TOSHIBA'S REQUEST FOR PRE-APPLICATION REVIEW OF THE
SUPER-SAFE, SMALL, AND SIMPLE (4S) REACTOR DESIGN

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PUBLIC MEETING

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TUESDAY,

OCTOBER 23, 2007

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The public meeting convened at 1:00 p.m.
in the NRC Auditorium, Two White Flint North, 11545
Rockville Pike, Rockville, Maryland, Donald E.
Carlson, Office of Nuclear Regulatory Research,
presiding.

NRC STAFF PRESENT:

DONALD E. CARLSON, New and Advanced Reactors Branch,
Office of Nuclear Regulatory Research
JOHN R. JOLICOEUR, Chief, New and Advanced Reactors
Branch, Office of Nuclear Regulatory Research

TOSHIBA PARTICIPANTS:

NORHIKO HANDA
OSAMU MAEKAWA
AKIRA OZAKI
YOSHIAKI SAKASHITA

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CRIEPI PARTICIPANT:

NOBUYUKI UEDA

WESTINGHOUSE PARTICIPANTS:

REGIS MATZIE

BRADLEY MAURER

RICHARD WRIGHT

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

1:02 p.m.

1
2
3 MR. CARLSON: Welcome, everyone. My name
4 is Don Carlson. I am from the NRC's Office of Nuclear
5 Regulatory Research, the New and Advanced Reactor's
6 Branch and I will be leading today's meeting.

7 In addition to the people here in the
8 room, we also have people who have phoned in on the
9 bridge line as public observers. We will let them
10 introduce themselves in a moment and there will be as
11 shown on the agenda an opportunity for public comment
12 at the close of the meeting.

13 The purpose of this meeting is to discuss
14 items related to Toshiba's request for a
15 preapplication review of its 4S reactor design and to
16 allow Toshiba the opportunity to present details of
17 its design and safety and security characteristics.

18 This meeting was, in fact, requested by
19 Toshiba and granted by the staff pursuant to the
20 Commission's Advanced Reactor Policy Statement which
21 encourages the developers of advanced reactor designs
22 to engage the staff in early interactions in order to
23 provide all interest parties including the public with
24 a timely and independent assessment of the safety and
25 security characteristics of advanced reactor designs.

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1 Okay. The next slide please. Okay.
2 There we go. Thank you.

3 First, I'll start off with some
4 formalities and then I'll be talking about some high-
5 level questions that both the preapplicant and the NRC
6 need to think about, go over the preapplication
7 objectives, get a few examples of possible
8 preapplication topics and then briefly review the
9 regulations for radioactive material transportation as
10 being a potential area that this design would have
11 unique attributes and then finally, I'll provide a
12 summary of some acronyms.

13 First of all, this is a Category 1 public
14 meeting. The protocol for which is that members of
15 the public are welcome to observe both in person and
16 by the bridge line phone and other than the
17 introductions in a moment, their comments and
18 questions should be reserved for the final session of
19 the meeting which is scheduled to start at 4:45, the
20 public comments session.

21 Please be careful to speak into the
22 microphone. We do have a court reporter and so, there
23 will be full transcripts issued of this meeting by
24 next week sometime.

25 And so, now, we will go around the room

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1 starting first with the people at the table from
2 Toshiba.

3 Regis, you want to start?

4 MR. MATZIE: Yes. My name is Regis
5 Matzie. I'm the Senior Vice President and Chief
6 Technology Officer for Westinghouse Electric Company.

7 MR. UEDA: I am Nobuyuki Ueda, Senior
8 Research Scientist and Sector Leader over Advanced
9 Reactor Systems in Nuclear Technology Research
10 Laboratory, Central Research Institution of Electric
11 Power Industry, CRIEPI. Thank you.

12 MR. MAURER: I am Brad Maurer with
13 Westinghouse. I'm a Principal Engineer with
14 Westinghouse.

15 MR. WRIGHT: I'm Rick Wright and I'm from
16 Westinghouse and I work in the New Plant Projects
17 Area.

18 MR. MAEKAWA: Osamu Maekawa, Technology
19 Executive of Toshiba Nuclear Energy Systems.

20 MR. HANDA: I'm Norihiko Handa. I am a
21 Senior Fellow of Toshiba.

22 MR. SAKASHITA: Yoshiaki Sakashita,
23 Manager from Toshiba Corporation.

24 MR. OZAKI: Akira Ozaki, Senior Manager of
25 Toshiba Corporation.

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1 MR. JOLICOEUR: And I'm John Jolicoeur.
2 I'm Chief of the New and Advanced Reactor's Branch in
3 Office of Research.

4 MR. CARLSON: I would like to remind
5 everyone here in person that to use the sign-up
6 sheets. If you haven't signed up already, please do
7 so during the breaks.

8 Also, out in the lobby or the atrium of
9 this auditorium, you will see that our Toshiba friends
10 have brought with them a very nice scale model of
11 their reactor design. So, you'll want to look at that
12 during the breaks as well.

13 Now, I'm going to give the people who have
14 dialed in, and I really don't know how many have at
15 this point, a chance to introduce themselves and how
16 many people do we have? Does anybody have an idea?

17 MR. SHAHROKHI: This is Farshid Shahrokhi
18 with Areva NP in Lynchburg, Virginia.

19 MR. CARLSON: Okay. Thank you. Next.

20 MS. RUNNER: This is March Runner, Louden
21 Tribal Council in Galena, Alaska.

22 MR. CARLSON: Louden Tribal Council in
23 Galena, Alaska, could you say your name again?

24 MS. RUNNER: March like the month. Runner
25 like around a track.

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1 MR. CARLSON: Thank you. Next.

2 MR. DEMOSKI: Peter Demoski from Nulato,
3 a small village 50 miles down river from Galena, the
4 proposed site of this nuclear facility.

5 MR. CARLSON: Did we get that name? Could
6 you repeat it please?

7 MR. DEMOSKI: Peter Demoski D-E-M-O-S-K-I.

8 MR. CARLSON: Thank you. Peter Demoski.
9 Next please.

10 MR. BURKE: Richard Burke, ISO New
11 England.

12 MR. CARLSON: Thank you. Next please. Is
13 anyone else on the line?

14 MR. ROSENFELD: Yes, Robert Rosenfeld R-O-
15 S-E-N-F-E-L-D. I work for the Yukon River Inter-
16 Tribal Watershed Council which is a treaty
17 organization made up of 66 indigenous government from
18 one end of the Yukon River to the other. I'd like to
19 be recognized tack on some comments towards the end
20 and invite Toshiba to call me at their earliest 907-
21 388-2683. Thank you very much.

22 MR. CARLSON: Thank you, Robert. Next.
23 Do we have anyone else on the line? Bodony. Yes, I
24 have your name. Thank you. Is there anyone else?
25 Last call. Okay. Thank you.

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1 Okay. Yes, you heard that we have some
2 members of the First Nations and Tribal Nations in the
3 area who are interested and we do have a Tribal
4 Consultation Working Group in the Agency to work with
5 them. That, however, is not the purpose of this
6 meeting and for the purposes of this meeting, they are
7 public observers and they'll be welcomed to have
8 comments at the end.

9 The purpose of this meeting again is to
10 address Toshiba's request for a preapplication review
11 for approval of the design of their 4S reactor. This
12 is one of a number of processes that the Agency will
13 have leading up to design approval or design
14 certification and site approval or early site permits
15 and all of these have various opportunities for public
16 participation at various levels.

17 So, thank you for your participation.

18 I would also note that we have public
19 comment feedback forms posted outside on the table and
20 members of the public are invited to use those.
21 Welcome your feedback.

22 Next slide then.

23 First of all, let's look at what some of
24 the high-level questions that the preapplication needs
25 to consider.

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1 First of all, what level of review is
2 desired for the preapplication? What will be the
3 submittals? Informal? White paper submittals?
4 Formal? Topical reports? Safety analysis reports?
5 How open items will be treated in going forward after
6 the preapplication review to the review of an eventual
7 application which would be read -- which would be
8 lead, excuse me, by the Office of New Reactors.

9 Also, what is your schedule for submittal
10 of the application and finally, what will the design
11 be formally aligned with a customer? This, of course,
12 would effect how the Agency views the priority of
13 allocating resources to these review activities.

14 Next slide.

15 High-level questions for the NRC, what
16 priority do we, the NRC, give these efforts relative
17 to ongoing efforts on advanced light-water reactor
18 combined license applications and also, the support
19 for DOE's next generation nuclear plant in global
20 nuclear energy partnership initiatives. The pebble-
21 bed modular reactor preapplication review which has
22 been ongoing and potential preapplication reviews for
23 other proposed reactors such as the IRIS, the High
24 Temperature Teaching and Test Reactor, Hyperion and so
25 on.

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1 A key point in all of this in determining
2 what priority and level of effort we allocate to this
3 is the availability of NRC resources in the coming
4 years as well as technical review staff with
5 appropriate expertise for non-LWR efforts. This are
6 very important considerations.

7 Next slide.

8 The preapplication objectives are to, in
9 our view, familiarize the NRC with the design. In
10 this case, an LMR design, liquid metal cooled reactor,
11 building on insights from our past liquid metal cooled
12 reactor reviews many years ago for the Clinch River
13 Breeder Reactor Project and in the early '90s for the
14 PRISM Reactor.

15 Also, we have ongoing interactions with
16 DOE on liquid metal reactor technology in the context
17 of the Global Nuclear Energy Partnership Project and
18 finally, we have plans for LMR, liquid metal reactor,
19 infrastructure research in the Office of Research.

20 We would like to provide feedback to the
21 Applicant on key safety, design and licensing issues
22 and their technology development programs in support
23 of licensing.

24 Furthermore, these activities should help
25 us plan and inform our infrastructure development work

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1 for research in the area of liquid metal cooled
2 reactors and provide for early identification of any
3 policy issues that may come up.

4 Just listing some examples of
5 preapplication focus topics that we have seen in past
6 reviews and we might anticipate in upcoming
7 preapplication reviews:

8 Analysis codes and their validation for
9 analysis of reactor safety is a frequent area of
10 consideration;

11 The approach to defense-in-depth, testing
12 and monitoring both for the reactor R&D program for
13 design and for the operational reactor once it's
14 built;

15 Safety classifications and treatments of
16 systems, structures and components;

17 The selection of licensing basis events,
18 transportation of radioactive materials, fuel cycle
19 and waste issues unique to the fuel cycle for a new
20 design, source term generation that refers to the
21 radio nuclides available for release in severe
22 accidents and long-term fuel performance might be of
23 interest in this particular review;

24 Probabilistic risk assessment and how it
25 is used;

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1 Nuclear analysis meaning in some reactors
2 there's an interest in reactivity feedback
3 coefficients for example;

4 Physical protection and security
5 especially in the aftermath of the events of September
6 11th, 2001, and;

7 Emergency planning.

8 There is no clear script that the NRC
9 staff follows for preapplication reviews. For
10 licensing reviews, there are standard review plans.
11 There are specific regulations that those correspond
12 to.

13 In the case of preapplication review, it
14 really is the preapplicant's responsibility and
15 prerogative to identify the topics that it wants to
16 staff to cover in the preapplication review, of
17 course, in consultation with the staff if desired.

18 Finally, I'll give a little overview of
19 the transportation regulations for radioactive
20 material. The reason I felt this might be of interest
21 is following the evolution of the 4S design, there
22 have been statements about transportability and so,
23 those seem to be of interest. So, reminding what the
24 regulations are in that domain, they are 10 CFR; that
25 is Title 10 of the Code of Federal Regulations Part 71

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1 for domestic shipments. For international shipments
2 of radioactive materials, there are corresponding and
3 very similar regulatory requirements in IAEA Safety
4 Standard Series Number TS-R-1.

5 These regulations apply to transporting
6 nuclear fuel from the fabricator to the proposed
7 reactor site, radioactive waste from the proposed
8 reactor site to a centralized low-level waste facility
9 and finally, spent nuclear fuel from the proposed
10 reactor site to a centralized geologic repository or
11 interim storage facility or reprocessing facility.

12 And you can quickly go through the
13 acronyms yourselves if you're interested.

14 And with that, I thank you and would like
15 to turn it over now to our guests from Toshiba.

16 MR. MAEKAWA: Good afternoon, ladies and
17 gentlemen. My name is Osamu Maekawa, Technology
18 Executive of Toshiba Nuclear Energy Systems.

19 On behalf of Toshiba, I'd like to thank
20 the Nuclear Regulatory Commission for this
21 opportunity.

22 It's our great pleasure to be here to
23 address the NRC for 4S which stands for Super-Safe,
24 Small and Simple Reactor preapplication review.

25 4S has the collaboration of Toshiba and

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1 the Central Research Institute of Electric Power
2 Industry of Japan since 1988. 4S is a small sodium-
3 cooled fast reactor with long-life core.

4 We believe 4S is the best fit to the
5 requirement of energy for remote or developing areas.

6 Nuclear is an affordable emission free
7 energy source and one with the most promising choices.
8 Again, this global warming by carbon dioxide
9 emissions.

10 We wish to contribute to the benefit of
11 nuclear energy to a wide area of the world through our
12 4S reactors.

13 Let me introduce our company, Toshiba,
14 briefly. We entered nuclear power business in 1966.
15 Since then, we have been continuing to construct
16 nuclear power plants. We have constructed 22 boiling
17 water reactors over the past 40 years. Seventeen of
18 them were as a main contractor.

19 In addition to those BWR construction
20 projects, we played a major role in constructing
21 advanced reactors such as fast breeder reactors, JOYO
22 and MANJU.

23 We cover the full spectrum of nuclear
24 technologies including research and development,
25 detail design, production and procurement,

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1 construction through the operation and maintenance.

2 In the first reactor development in Japan,
3 we played a major role as the management company in
4 the experimental reactor JOYO and provided coring
5 tunnels, control rod drive, the containment vessel and
6 other equipment.

7 For the prototype reactor MANJU, we
8 supplied the reactor closure head, the intermediate
9 heat transport system, the traveling generator system
10 and other equipment.

11 In addition to those, we have been
12 continuing design and research and development
13 activities for demonstration and commercial first
14 reactors.

15 Now, I'd like to introduce the 4S team.
16 Along with Toshiba, 4S Development Team consists of
17 Central Research Institute of Electric Power Industry
18 of Japan, Argonne National Laboratory and Westinghouse
19 Electric Company.

20 Our team hopes today's meeting will give
21 you a good understanding of our plan and technology.
22 We look forward to working with you to achieve the
23 certified design of the 4S.

24 Thank you all for coming to this meeting
25 and thank you for your attention.

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1 At this time, I would like to introduce
2 Dr. Ueda of CRIEPI. Dr. Ueda, please.

3 MR. UEDA: Good afternoon, ladies and
4 gentlemen. I am Nobuyuki Ueda, Senior Research
5 Scientist of Central Research Institute of Electric
6 Power Industry, CRIEPI.

7 It gives us considerable pleasure to have
8 an opportunity to present our 4S reactor.

9 First, I briefly introduced our institute.
10 Central Research Institute of Electric Power Industry,
11 CRIEPI, has been extensively contributing to the
12 society through research and development for insuring
13 the stable electricity supply since the establishment
14 in 1951. CRIEPI is mainly supported by Japanese
15 utilities and CRIEPI's similar institute is EPRI in
16 United States.

17 We have two missions. As a first mission,
18 we conduct fundamental pioneering research on the
19 electric industry.

20 The second mission, we offer the results
21 of this research to the public for the benefit of all.

22 And we set up the three research target:
23 Cost reduction and greater reliability; harmonization
24 of energy and environment; creation of comprehensive
25 energy service.

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1 We select research topics and consolidate
2 resources based on five spheres. One of the spheres
3 is nuclear technology. In the nuclear technology
4 sphere, there are light water reactor technology, fuel
5 cycle technology, back-end technology, spent fuel
6 waste technology and fast reactor technology.

7 We started fast reactor research and
8 development in early 1980s. We have carried out the
9 conceptual design study of innovative fast reactors,
10 the pilot process fuel recycling technology and the
11 fundamental fast reactor design technology, high
12 temperature performers over structural materials,
13 seismic isolator and share backend performers over
14 reactor vessel.

15 We have also developed several numerical
16 codes as design tools. 4S has been developed by
17 compiling these technology as well as the technologies
18 of Toshiba and Westinghouse.

19 We would like to present the 4S to you
20 with all our technologies.

21 Thank you for your attention.

22 MR. MATZIE: Again, my name's Regis
23 Matzie. I'm the Chief Technology Officer of
24 Westinghouse Electric Company.

25 On behalf of Westinghouse, I would like to

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1 thank the Nuclear Regulatory Commission for this
2 opportunity to support Toshiba in their preapplication
3 efforts to certified 4S.

4 As you are aware, Westinghouse is the
5 world leader in advanced reactor design. We have a
6 long history of innovation starting with the power
7 plant for the U.S.S. Nautilus, the world's first
8 nuclear submarine and continuing with the first U.S.
9 commercial nuclear power plant at Shippingport,
10 Pennsylvania. Over half of the world's operating
11 reactor power plants are based on Westinghouse
12 technology when the plants built by our licensees are
13 included.

14 Our experience with liquid metal cooled
15 reactors is also very significant. We were the prime
16 contractors for both the Clinch River Breeder Reactor
17 and the Fast Flux Test Reactor and we also
18 participated in the advanced liquid metal reactor
19 program called PRISM thereafter.

20 Unfortunately, the United States turned
21 away from liquid metal cooled reactor technology in
22 the 1980s and thus, there's been a gap in our intimate
23 involvement in this technology.

24 Nevertheless, Westinghouse has not been
25 standing still. We have developed three advance light

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1 water reactors over the past two decades and achieved
2 design certification for all three of these. The last
3 being the AP-1000 advanced passive plan.

4 In addition, we are involved with design
5 development and the preapplication review of two other
6 advanced plans, IRIS and PBMR.

7 Thus, Westinghouse's leadership in
8 advanced reactor licensing continues. We are pleased
9 to apply this experience and leadership in licensing
10 advanced nuclear plants to the 4S reactor. We will
11 work closely with our colleagues from Toshiba to
12 insure that this licensing effort is successful and
13 that it meets the expectations of the Commission.

14 Thank you very much for allowing me to
15 make these brief remarks.

16 MR. MAURER: Good afternoon. My name is
17 Brad Maurer. I'm with Westinghouse.

18 I would first like to add my thanks to the
19 NRC staff for meeting with us afternoon and in
20 particular, I would like to recognize Don Carlson in
21 his efforts in helping us to arrange this meeting this
22 afternoon.

23 We are here in what we hope is the first
24 of series of preapplication meetings on the 4S
25 reactor.

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1 Before I go on, I would like to echo what
2 Don mentioned at the breaks. Please feel free to go
3 into the atrium and take a look at Toshiba's model.
4 It's quite impression. There will be Toshiba and
5 Westinghouse people nearby to answer your questions.

6 Also, Don, I would like to ask your help.
7 If we run long and need a break, there are a number of
8 natural breaks in the presentation. So, just let me
9 know.

10 The goals of the 4S reactor are to provide
11 clean, safe, reliable and grid-appropriate power.
12 Grid appropriate means that the reactor is sized to
13 fit the need and locations where large power plants or
14 transmission of power from large power plants is not
15 practical or available.

16 The second goal is to minimize security
17 and proliferation risks and the third is to minimize
18 the infrastructure operation and maintenance
19 requirements of the plant.

20 Our meeting objectives today are to
21 provide an overall introduction of the 4S, its basic
22 operation, its main safety features, what we've done
23 so far in the design and the verification of that
24 design.

25 We wish to gain U.S. NRC guidance on the

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1 overall process to be followed from licensing the 4S
2 in the U.S. We would like to offer our approach and
3 request feedback from the staff on that approach. We
4 would like to establish a continuing dialogue with the
5 NRC staff. As you will see, we hope that the flow of
6 information can also continue to the further submittal
7 of technical reports and through further meetings.

8 Our goal is to submit the design approval
9 application by 2009.

10 This is our presentation agenda today. We
11 will go through a high-level overview, plan design
12 parameters, regulatory conformance, main design
13 features, metallic fuel experience and design
14 verification testing, safety analysis and our
15 conclusions. Well, this is not one-to-one with the
16 published agenda in the public meeting notice, we will
17 address all of those items and those included the 4S
18 overview, current status of the design, testing and
19 analysis that has been performed and that is planned
20 to be performed and initial submittals of technical
21 reports.

22 We want to give you a feel for what the 4S
23 looks like, it's basic features and how it operates.
24 Also, a status of the design and our proposed
25 licensing approach.

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1 The 4S is a sodium-cooled fast reactor.
2 The size is 30 megawatts thermal which is about 10
3 megawatts electric. This is roughly 1 percent of the
4 size of a typical reactor such as the AP-1000 which is
5 about 3400 megawatts thermal.

6 The application for a small reactor like
7 4S is for areas of small concentrated need such as the
8 city of Galena in Alaska. It also has the potential
9 for oil sand processing seawater desalination. It is
10 considered a candidate for the GNEP grid appropriate
11 in small and medium reactor design. This means it's
12 a candidate for funding for research and testing.
13 We're hopeful currently for additional funding from
14 CRIEPI in Japan through the GNEP process.

15 The main features of the 4S include
16 passive safety both in the negative coolant
17 temperature reactivity coefficient in the design of
18 the core and also the decay heat removal systems.

19 There is no on-site refueling for 30 years
20 with the 4S. There is low maintenance requirement
21 with the 4S. This comes from the no refueling and the
22 use of electromagnetic pumps and finally, a high
23 inherent security.

24 As can be seen from the sketch, the bulk
25 of the plant can be sighted below grade and there is

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1 no on-site storage of either new or spent fuel.

2 The core of the 4S is made up of metallic
3 fuel, uranium and 10 percent zirconium. The activity
4 control is by movable reflectors. There are no
5 control rods. This utilized the high-leakage core
6 design which allows the reflector control of the
7 reactor.

8 The shutdown system is by the reflector
9 which drop out of the core region if they need to
10 shutdown the reactor and also by the shutdown rod.
11 So, we have not only diverse, but redundant shutdown
12 systems.

13 The primary heat transport system includes
14 the annular type electromagnetic pumps which have no
15 moving parts and moves the liquid sodium through the
16 reactor by induced magnetic fields. Also, the
17 intermediate heat exchanger which is the IHX. This is
18 an annular type inside the reactor. This is where the
19 heat from the primary system, primary sodium system,
20 inside the reactor is transferred to the intermediate
21 sodium heat transfer system.

22 Also, I would point out that the
23 containment system consists of a guard vessel around
24 the reactor vessel which is somewhat difficult to see
25 in this picture and also, the top dome which you can't

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1 see above the reactor in this shot -- in this picture.
2 The top dome encloses the reflector drives, the
3 shutdown drive and the other penetrations at the top
4 of the reactor vessel.

5 There are two heat transport systems. The
6 primary heat transport system as I mentioned is
7 totally contained inside the reactor. The
8 intermediate heat transport system is the steam
9 generator, the EM pump, the air cooler and dump tank
10 and then we have the water and steam system to the
11 turbine generator.

12 The primary coolant is circulated up
13 through the core in the primary coolant system to the
14 top of the vertical baffle and then down through the
15 intermediate heat exchanger around the annulus of the
16 reactor vessel heating the intermediate sodium. The
17 primary coolant is then drawn through the
18 electromagnetic pumps through the shielding
19 surrounding the core and back up through the core.

20 The immediate coolant flow is from the
21 immediate heat exchanger in the reactor through the
22 steam generator flow down through the tube region in
23 the steam generator out of the steam generator through
24 the air cooler which has no function during normal
25 operation and back to the intermediate heat exchanger

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1 in the reactor.

2 Super-heated steam is generated inside the
3 steam generator tubes and, of course, to the turbine
4 generator.

5 This picture shows an elevation shot of
6 what the plant would look like. As you can see, the
7 reactor vessel and the steam generator are located in
8 the reactor building and this includes both sodium-
9 transfer systems, the primary system which, of course,
10 is within the reactor and also the intermediate heat
11 transfer system.

12 The reactor building is supported on
13 seismic isolators which greatly reduces the earthquake
14 response of the primary and intermediate heat
15 transport systems. You can see in the corner of this
16 picture is a sketch of what one of those isolators
17 looks like.

18 Status of the 4S design, significant
19 testing has been performed which supports the 4S.
20 We've had decades of experience with sodium bonded
21 metal fuel. Sodium bonded fuel means that there is
22 sodium inside the fuel pins between the cladding and
23 the fuel slug itself.

24 We've done integrated tests. The critical
25 experiment which is verification of the physics design

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1 methodology for reflector control core and also heat
2 transfer tests of the RVACS which is the Reactor
3 Vessel Auxiliary Cooling System. We've also performed
4 system and component tests applicable to the 4S in the
5 area of fuel hydraulic test, test of reflector drive
6 mechanism, sodium tests of the steam generator, sodium
7 tests of the EM pump and tests of seismic isolators.
8 These tests will be discussed in more detail later in
9 the presentation.

10 As you can see, design work on the 4S has
11 been in progress for many years. The conceptual
12 design of the 4S was initiated 20 years ago.
13 Preliminary design and progress over the last five
14 years is now complete and detailed design work is
15 underway. In addition, many international papers have
16 been published relative to the 4S design work.

17 This slide shows a rather busy
18 representation of the organizations involved in the
19 4S.

20 Toshiba is the overall project lead. It
21 is involved in component and system engineering design
22 and analysis, nuclear components, electrical system
23 and the turbine generator. CRIEPI is involved with
24 materials and component research, structural
25 standards, fuel analysis and safety analysis.

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1 Argonne National Laboratory has provided
2 the technical support function in the development of
3 the fuel and reactor safety.

4 Westinghouse is providing a licensing
5 focus for the 4S in the U.S.

6 This is an overview of our proposed
7 licensing approach. We are proposing a simplified
8 schedule for achieving design approval.

9 In phase one, meetings with the NRC
10 starting today with subsequent meetings to focus on
11 more specific subject areas such as fuel design,
12 safety design and seismic isolator issues will be
13 discussed.

14 Phase two includes submittal of technical
15 reports for NRC review.

16 Phase three is the submittal and review of
17 design approval application culminating in the design
18 approval FSER.

19 In the graphic, we have included the
20 superimposition of a COL on this process. While this
21 does not represent any predetermined or specific
22 application, the city of Galena has expressed
23 tremendous interest in the 4S and has, in fact,
24 expended large amounts of effort in their early work
25 in white paper generation in trying to go forward with

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1 the 4S at Galena.

2 This shows our proposed licensing approach
3 and schedule for phase one. We are proposing this
4 schedule for a series of subsequent meetings with the
5 NRC. Obviously, the first one being today.

6 For example, we would suggest a second
7 meeting that could include more detailed discussions
8 on such subjects as fuel design and the safety and
9 system designs. Other topics for subsequent meetings
10 could include seismic isolation, regulatory
11 conformance and the PIRT which is Phenomena
12 Identification and Ranking Table which is currently in
13 progress.

14 We understand that the NRC must work
15 through its own process to evaluate budget and
16 availability of resources. This is a schedule that we
17 are proposing and which we would like the NRC to
18 consider in their evaluation of what they can support.

19 Phase two would include the submittal of
20 various technical report for NRC review. As you can
21 see, the subjects are similar to phase one, seismic
22 isolation, long-life metallic fuel, analysis
23 methodology, safety analysis, PRA and the PIRT and
24 test program.

25 We have provided this projection of phase

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1 two technical report submittals throughout 2008 for
2 NRC review to support our proposed submittal for the
3 application in 2009. There are discussions.
4 Additional reports will likely be identified that
5 would be necessary to support the NRC's review.

6 These next few slides show some of the
7 basic physical and operational parameters of the 4S.
8 Here we show the basic plan parameters, inlet and
9 outlet temperatures for the primary and intermediate
10 sodium heat transport systems and the mass flows.

11 The core has a relatively small diameter,
12 less than 1 meter and is relatively a long slender
13 core.

14 Fuel enrichment is in the range of 17 to
15 19 percent with a relatively low burn-up. Also, note
16 that while the temperatures are high which allows
17 high-quality steam to the turbine, the system pressure
18 is quite low at about .3 megapascals.

19 The primary electromagnetic pumps are
20 again of a single state or design, linear annular
21 induction pump. Intermediate heat exchangers located
22 in the reactor vessel are a shell-and-tube type with
23 straight tubes. The steam generator design includes
24 a double-wall design with helical coil type and also
25 includes leak detection capability.

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1 The containment once again consists of the
2 guard vessel on the top dome. Okay. That's all for
3 that one.

4 Now, we'd like to get into regulatory
5 conformance. The current status of our code and
6 regulatory conformance activities are the generation
7 of principal design criteria for the 4S. That has
8 been completed.

9 Regulatory guide applicability and
10 exceptions, that has been completed.

11 Applicable codes and standards have been
12 identified and applied.

13 For the principal design criteria, we
14 started with the GDC Appendix A. We used the guidance
15 from 52.47 and staff reviews of previous liquid metal
16 reactor designs including Clinch River and PRISM.
17 We have kept the criteria that was applicable to the
18 4S and we've replaced or modified criteria that are
19 not applicable to the liquid metal reactors.

20 The results of this effort are that about
21 50 percent of the Appendix A criteria are applicable
22 to the 4S. Approximately 45 percent of the criteria
23 identified in the PDC came from the PRISM and the
24 Clinch River staff reviews and approximately 5 percent
25 of those criteria are specific to the 4S design.

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1 Our approach with the regulatory guides
2 was somewhat similar as for the primarily design
3 criteria. We used the guidance in part 52 of SECY
4 94084 which is non-safety systems in passive plant
5 designs and the SRP which expands on the application
6 of reg guides.

7 We have characterized the applicability of
8 the reg guides in terms of whether they are
9 applicable, inapplicable or partially applicable in
10 which case the intent of those reg guides has been
11 applied to the 4S.

12 The results of that, we have identified
13 exceptions to the reg guides and we have justified the
14 following -- these exceptions using or applying the
15 following reg guide divisions. Division one which is
16 power reactors, four environmental and sighting, five
17 materials and plant protection and division eight,
18 occupational health.

19 Applicable codes and standards. The
20 applicable codes and standards have been identified
21 and applied. These are some of the major components:
22 reactor vessels and internals, steam generator,
23 reactor protection system and so forth.

24 The major codes that are used some of them
25 are ASME, ANSI and ANS standards and IEEE codes.

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1 New codes will need to be identified and
2 have been identified. New code needs have been
3 identified and are being or will be developed and one
4 example for that is for the seismic isolators.

5 The QA program for the 4S will meet the
6 requirements of 10 C.F.R. 50 Appendix B and ASME NQA-
7 1.

8 The main design features of the 4S.
9 First, we'd like to go through the safety features and
10 then there are four key features of the 4S that we'd
11 like to spend a bit more time on and those four key
12 features are passive safety, no on-site refueling for
13 30 years, low maintenance requirement and high
14 inherent security.

15 The safety features include low-pressure
16 system with a pool design and guard vessel. There is
17 no LOCA in this design. Negative coolant temperature
18 coefficient promotes safe stable operation. There's
19 a large margin to coolant boiling or cladding failure
20 even when applying beyond design basis assumptions.

21 Reliable, redundant and diverse scram
22 systems. These systems are the reflectors which move
23 away from the core region by gravity and also the
24 shutdown rod which inserts into the core also by
25 gravity.

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1 The design reduces the excess reactivity
2 in metallic fuel core -- with the metallic fuel core
3 design and limits the potential for reactivity
4 insertion accidents.

5 Passive and reliable diverse shutdown heat
6 removal systems. These include the Reactor Vessel
7 Auxiliary Cooling System or RVACS and the Intermediate
8 Reactor Auxiliary Cooling System, IRACS. Either
9 system is sufficient to maintain cooling.

10 Continuing with the safety features, fuel
11 sodium chemical compatibility which allows run beyond
12 cladding breach. Double-walled steam generator tubes
13 with leak detection protects against sodium water
14 reaction. The tubes provide a double barrier as the
15 leak detection system will detect a leak in either the
16 inside tube or the outside tube.

17 Past experience has been applied to the
18 design features to mitigate the effects of a secondary
19 sodium leak. The addition of a sodium drain system
20 has been added which drains the secondary -- the
21 intermediate system sodium to the sodium dump tank in
22 the event of a sodium leak.

23 And finally, the capability to survive
24 beyond design basis events without core damage.

25 As mentioned previously, large margins are

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1 shown even in beyond design basis events.

2 Let me explain a bit what this slide is
3 intending to show. The white boxes on the left are
4 the target for the design, what we hope to achieve.
5 The design feature in the blue box is what actually
6 was implemented in the design and then the yellow box
7 shows what the design feature achieved.

8 In this case for passive safety, the first
9 target was passive reactor shutdown capability. The
10 design feature which promotes this is a long
11 cylindrical core with a small diameter and what this
12 achieves is a negative coolant temperature reactivity
13 coefficient and this promotes the passive reactor
14 shutdown capability.

15 Secondly, passive decay heat removal.
16 There are two redundant and diverse heat removal
17 systems, the RVACS and the IRACS. Both of these
18 systems utilize natural circulation of the sodium
19 coolant and also natural circulation of air and either
20 system is sufficient to cool the reactor.

21 This slide shows some results from
22 analysis of a beyond design basis event demonstrating
23 the passive shutdown. This particular event is the
24 unprotected sudden loss of flow. The assumptions in
25 this event were a loss of power -- loss of off-site

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1 power plus a loss of flow coast down plus a loss of
2 both diverse scram systems.

3 As you can see from the chart on the left,
4 large margins to coolant boiling and much larger
5 margins to fuel melt are demonstrated.

6 On the right, you can see the makeup of
7 the negative reactivity. The negative reactivity is
8 very effective in shutting down the reactor in an un-
9 scrambled event.

10 I would like to point out if you look at
11 the lowest curve in the right-hand chart, you see the
12 net reactivity and you follow that up and it appears
13 to be continuing on an upward direction when the chart
14 was cut off. Actually, the behavior of that curve
15 asymptotically reaches zero if you carry that curve
16 out far enough.

17 This shows you the core region of the 4S.
18 Let me see if I can get this thing to work. This is
19 going to be difficult.

20 If you look at the vertical section of the
21 core on the left, where is it? There we go. Well, I
22 can't get the pointer. Yes, if you would point to
23 first the dark blue sections on the left.

24 Those are the reflectors in the reactor
25 which move on the outside of the fuel up and down. As

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1 they move up into the core, the reflectors increase
2 the reactivity in the core. The light blue segments
3 above the reflectors are called cavities and these are
4 basically empty sealed cavities filled with argon and
5 what that does is allow maximum neutron leakage from
6 the core. So, as the reflectors move up in the core,
7 more and more neutrons are reflected back into the
8 core following the core burn-up. So, throughout core
9 life, these reflectors are moved up into the core and
10 maintain the power level throughout the core life.

11 In the planned view in the center, the
12 dark blue circle shows the reflectors. There are
13 actually six segments there. It's hard to see the
14 black lines.

15 In the center, you can see the 18
16 hexagonal fuel assemblies with two enrichments. The
17 outer -- if you look, there's kind of like an outer
18 row and an inner row. The outer row is the higher
19 enrichment fuel which is 19 percent and the inner row
20 is 17 percent enrichment. Again, there are a total of
21 -- I believe it's 18 fuel assemblies. Okay.

22 The passive heat decay removal systems
23 again as I mentioned utilize natural circulation of
24 the sodium in both the primary and intermediate
25 systems and also natural circulation of air.

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1 The RVACS, which is the Reactor Vessel
2 Auxiliary Cooling System, circulates air down around
3 the guard vessel, around the vessel and then back up
4 through exhaust stacks shown as the air outlet in the
5 red air path on the sketch.

6 The IRACS involves an air cooler which is
7 a part of the intermediate sodium coolant system and
8 in the event that the IRACS is needed to cool the
9 core, dampers are opened at the air cooler that allows
10 natural circulation of coolant air through the air
11 cooler. Natural circulation of the sodium then
12 carries the heat from the intermediate heat exchanger
13 in the reactor vessel through the intermediate system
14 and up to the air cooler where the heat is exhausted.

15 I want to emphasize that the decay heat
16 removal systems are redundant and diverse and either
17 system is capable of removing heat from the reactor.

18 No on-site refueling for 30 years.
19 Obviously, the target for this feature was a long-life
20 core. The design features that contribute to this are
21 high volume fraction metallic fuel core and a long
22 cylindrical core with a small diameter. These two
23 features achieve a small burn-up reactivity swing due
24 to larger amounts of fuel.

25 And the third design feature is the

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1 reflector controlled core which achieves neutron
2 leakage control which is how the reactor power is
3 controlled.

4 These design features contribute to the --
5 actually allow the design of the long-life core.

6 The fuel volume fraction for the 4S is
7 about 50 percent. This compares to about 40 percent
8 for the typical liquid metal reactor. Again, as I
9 mentioned before, the sodium -- the fuel is sodium
10 bonded metallic fuel which means there is sodium
11 inside the cladding between the cladding and the fuel
12 slug which gives the fuel a high thermal conductivity
13 and the fuel integrity is maintained for 30 years.

14 The burn-up for this fuel design is
15 consistent with our experience range with the EBR-II
16 which is the experimental breeder reactor II.

17 Also, we have demonstrated that the fuel
18 pins maintain their integrity against creep damage
19 also for 30 years. This is done using the computer
20 code developed by Argonne called, yes, life metal and
21 we'll mention that a little later.

22 And you can see in the rest of this slide
23 various of the fuel parameters.

24 The 30-year design life results in a low-
25 fuel burn-up and also a low power density in the core.

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1 Now, this demonstrates the operation of
2 the reflector controlled core.

3 Rick, if you would point out again the
4 reflector and the cavity on the left-hand side. The
5 reflector again is the dark blue and the light blue
6 are the cavities that sit about the reflectors. The
7 fuel is on the inside. I guess that's kind of a dark
8 red color on the picture. The reflectors move up on
9 the outside of the core and their purpose is to
10 reflect neutrons back into the core.

11 Now, the sketches on the right, if you
12 look at the far right-hand sketch, this is the
13 position of the core.

14 Would you indicate the reflector, Rick?

15 That's the reflector. You can see that
16 its position is mostly below the core region.

17 At reactor start-up, the reflectors are
18 drawn up into position until criticality is reached
19 with the reactor and this is done using the high-speed
20 drive mechanism shown in the sketch.

21 Once criticality is reached, the low-speed
22 drive mechanism is used which maintains a steady
23 upward movement of the reflector which compensates for
24 the burn-up of the fuel throughout the fuel life.

25 When I say a slow movement, the movement

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1 of the reflector during normal operation is
2 approximately 1 millimeter per week.

3 The low-maintenance requirement. The
4 target here was the low maintenance -- was the
5 maintenance-free reactor internals.

6 The design features were, first, the
7 reflector. The use of the reflector eliminates the
8 need for control rods and the replacement of control
9 rods. The electromagnetic pump which eliminates any
10 moving parts in the reactor -- in the reactor pumps
11 and also the material selection which provides a
12 compatibility between the coolant and the internal
13 structures.

14 As I mentioned, the electromagnetic pumps
15 have no moving parts. They develop head through use
16 of a magnetic field which draws the liquid metal
17 coolant through the pump annulus. The EM pump is
18 totally emersed in the sodium coolant and is cooled by
19 the sodium coolant. In this way, the heat generated
20 by the EM pump is contained totally in the coolant and
21 within the reactor. This results in a very efficient
22 pump operation.

23 The fourth key feature is a high inherent
24 security. The target is the ability for below-grade
25 sighting to protect the reactor from external hazards

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1 and, of course, the design feature that helps promote
2 this is the small size of the reactor.

3 Secondly, the target is a sealed reactor
4 and no on-site fuel storage and the design feature
5 that allows this to occur is that no refueling is
6 needed for 30 years.

7 As you can see in the below-grade
8 sighting, both the reactor and the steam generator
9 including the primary sodium transport system and the
10 intermediate sodium transport system are all located
11 below grade.

12 Now, just a brief summary of the main
13 design features. Passively achieved fundamental
14 safety functions, this is performed using passive
15 reactor shutdown and passive decay heat removal. It
16 allows simplified operation and maintenance achieved
17 by no on-site refueling. Reflector control which
18 eliminates the need for control rods. The
19 electromagnetic pumps and material capability. It
20 enhances security and proliferation resistance with
21 the possibility for below-grade sighting, a sealed
22 reactor and no on-site fuel storage either for new or
23 spent fuel.

24 Do you want to take a break now?

25 MR. CARLSON: Yes, we can take a break

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1 now.

2 MR. MAURER: Okay.

3 MR. CARLSON: We're actually ahead of
4 schedule and so, I would propose we break for 20
5 minutes and be back at 2:30.

6 (Whereupon, at 2:07 p.m., off the record
7 until 2:31 p.m.)

8 MR. CARLSON: Okay, we can start back in
9 again. I would suggest that there were some
10 interesting discussions around the model. Questions
11 were answered. I could volunteer one that was
12 answered. The question what material are the
13 reflectors made of. The answer I heard was ferritic
14 steel. Is that correct?

15 MR. HANDA: The material is modified 9 CR-
16 1 Mo steel is the material.

17 MR. CARLSON: Do you remember anything
18 else that was discussed during the break that actually
19 provided information that was not in the meeting
20 itself so far?

21 MR. MAURER: I wasn't here. Rick, do you
22 recall?

23 MR. WRIGHT: I think it was just general
24 questions about how things operated and what pieces
25 were where. Nothing was really new that I heard.

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1 MR. CARLSON: Okay. Let's resume with the
2 presentation. Thanks.

3 PARTICIPANT: If you could identify the
4 page numbers if you recall from time to time so folks
5 following by telephone can try and follow as well.

6 MR. MAURER: Okay. Sure. Thank you.

7 PARTICIPANT: Thanks.

8 MR. MAURER: Okay. We are going to
9 continue on. The next section to talk about is
10 metallic fuel experience and design verification
11 testing. We are on slide No. 40.

12 Extensive experience has been gained in
13 the EBR-II with uranium zirconium fuel. In
14 particular, on this slide I would like to emphasize
15 that over 16,000 uranium zirconium pins irradiated at
16 the EBR-II reactor without failure during operating
17 conditions.

18 Also, I would like to point out the longer
19 length fuel that was tested in the FFTF, this longer
20 fuel is more representative of the 4S fuel pins. I
21 would also like to point out the large experimental
22 database of the post-irradiation examination data.

23 We also have significant experience in
24 transient fuel performance. The transient reactor
25 test treat transient test, fuel behavior test

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1 apparatus out of pile test, whole-pin furnace test,
2 and run beyond the cladding breach. Also, there are
3 fuel cladding interaction diffusion couples testing on
4 a lab scale.

5 Evaluation of the 4S fuel is performed
6 using the LIFE-METAL code developed by Argon National
7 Labs. This code has been validated against the
8 extensive experience base that we have and is used to
9 validate the performance of the 4S fuel. The results
10 show that the 4S fuel retains its integrity over the
11 30-year lifetime at expected operating conditions.

12 I would like to point out in this figure.
13 It's very light-colored so I don't think the pointer
14 will work. If you look at the picture on the right in
15 this slide you will see a white circle around the
16 outside. The white represents the cladding. By the
17 way, this is a cross section of an irradiated fuel
18 pin. The white circle represents the cladding of the
19 fuel and the shaded portion on the inside in this case
20 represents an irradiated fuel slug.

21 In a new fuel pin you would see a gap
22 between the fuel slug and the white cladding and that
23 gap would be filled with sodium, what we call sodium
24 bonded fuel. As the fuel is burned up and the fuel
25 expands towards the cladding, the sodium is pushed or

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1 extruded up toward the top of the fuel pin which has
2 a relatively large plenum which is typical of liquid
3 metal fuel pins and allows enough room for the sodium
4 to be extruded up into the pin and also room for the
5 fission gases.

6 There have been many tests which support
7 the 4S systems and components. We have tested the
8 various design features, long cylindrical core with
9 small diameter, reflector-controlled core, high-volume
10 fraction metallic fuel core, the reflector, RVACS,
11 electromagnetic pumps, steam generator with double-
12 wall tubes, and the seismic isolation.

13 I won't go through all the information on
14 this graph. I want to note that most of these tests
15 have been completed. There are two tests that are
16 currently planned, further testing on the
17 electromagnetic pumps and also on the steam generator
18 double-walled tube design.

19 We have some additional information on
20 these tests in the following slides. We are now on
21 slide 45. The critical experiment test was done to
22 validate the design methodology for reflector
23 controlled core. The criticalities predicted by
24 analysis methodology which has been validated by
25 testing. The results of this test showed good

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1 agreement. It meets the major neutronics
2 characteristics within sufficient accuracies.

3 Next the heat transfer test of the RVACS.
4 The test apparatus sketch is shown on the left side of
5 your slide and the picture of the apparatus in the
6 middle. The purpose of this test was to determine
7 heat transfer co-efficient between the vessel and the
8 air. Of course, the results of this test actually
9 developed this correlation.

10 You will note in the sketch on the left of
11 the test apparatus if you look close enough there is
12 a small exhaust fan in the test setup. This is to
13 generate a prototypic air flow during the test so that
14 we could obtain the proper data. In the actual RVACS
15 design in the 4S of course there is no fan. This is
16 a completely passive design.

17 Also fuel hydraulic tests have been
18 performed to verify the pressure drop for the high-
19 volume fraction metallic fuel including the grid
20 spacer. The results of these testing -- well, the
21 test used a fuel design which is the same as the 4S
22 design fuel. The results were the development of the
23 empirical equation for pressure drop and also a
24 selection of the grid spacer design itself designed
25 for a low-pressure drop.

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1 The reflector drive mechanism has also
2 been tested on a scale model test. The purpose of
3 this test was to evaluate being able to maintain the
4 slow speed of the reflector as it is pulled up into
5 the core or beside the core to maintain the
6 criticality in the core during operation. The results
7 of this test confirmed the target speed within an
8 accuracy of plus or minus one micron per hour.

9 Sodium test of the steam generator tubes
10 were performed at ETEC which is Energy Technology
11 Engineering Center near Los Angeles. I might point
12 out that the majority of these tests were performed in
13 Japan. The ETC test and also the following
14 electromagnetic pump tests were performed at the ETEC
15 facility.

16 The sodium test of the steam generator
17 included double-walled tests and the tubes were
18 divided into two groups in the test. One had a wire
19 mesh between the inner and outer tubes. The other had
20 no mesh between the inner and outer tubes.

21 In each group of tubes there were also
22 three tubes that were included in the leak detection
23 system so it also detected or tested the leak
24 detection system for inner tube failure. Sodium test
25 of the electromagnetic pump was performed in sodium

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1 for a period of over 2,500 hours and from the
2 integrity of the stator support and the coil
3 insulation up to a temperature of 600 degrees C taken
4 from the flow stability in the required operating
5 range.

6 The comparison of the tested pump to the
7 4S pump, the tested pump diameter was 1.7 meters in
8 diameter and the pump designed for the 4S reactor is
9 2.5 meters in diameter. The flow has shown on the
10 figure here for the tested pump was 160 cubic meters
11 per minute while the flow in the 4S reactor is only 10
12 meters per minute. This is also an area where
13 additional testing will be done. We'll get to that in
14 just a minute.

15 Test of seismic isolator has also been
16 performed to confirm seismic isolator characteristics
17 and confirm design assumptions. The results of these
18 tests were to confirm linear critical strain, static
19 shear modulus, and Youngs modulus of the isolator
20 material.

21 Toshiba is now in the final process of
22 building a new test facility including a sodium test
23 loop in Japan. The test facility is scheduled to be
24 complete by the end of this year with functional
25 testing to begin early next year.

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1 Two tests have now been identified to be
2 run in this facility. One is a demonstration of a
3 large-scale electromagnetic pump of the same diameter
4 as the 4S pump and the second test would be a test of
5 steam generator tubes also of double-wall design.
6 They would include leak test of the outer tubes or
7 leak test including leakage through the outer tubes.

8 This shows a summary of the 4S testing.
9 4S design has taken large advantage of a large
10 experimental base both in Japan and internationally.
11 Metallic fuel has been extensively tested. The 4S
12 fuel design has been verified based on this testing
13 base and performance simulations. Unique 4S features
14 are supported by extensive testing.

15 In addition, we have more testing in the
16 new sodium loop facility being built by Toshiba. The
17 specific tests that are planned now again are the
18 electromagnetic pump test and steam generator tube
19 test.

20 The last subject area that we have --

21 MR. CARLSON: Would this be a good time to
22 solicit questions from the staff?

23 MR. MAURER: If you want. We've got just
24 one section to go if you want to wait until the end or
25 we can do it now. It's just a few more slides, Don.

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1 Okay. Our last section is the safety
2 analysis section. We are currently on slide 55. Many
3 design basis and beyond design basis events have been
4 postulated for the 4S. A number of these events have
5 been analyzed as well. This demonstrates a listing of
6 the design basis events that have been analyzed. The
7 underlying event, which is the loss of off-site power,
8 was chosen as a typical design basis event that in a
9 couple of slides we will show you the results for.

10 Also we have looked at the analysis of
11 several beyond design basis events. Again, we have
12 underlined in this case the unprotected loss of flow
13 event. this is a representative event which we have
14 chosen to provide some results for in this
15 presentation. The unprotected loss of flow in this
16 case was a loss of off-site power coincident with the
17 loss of both diverse scram systems.

18 It's important to note that comprehensive
19 analysis has been performed to identify accident
20 sequences. Our preliminary results show that there
21 are no sequences that have been identified that result
22 in core damage.

23 This sketch shows the nodalization diagram
24 of the ARGO-3 model which is used in these
25 evaluations. The model includes point kinetics,

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1 spacial effects of reactivity feedback, multiple
2 channels in the core, and one-dimensional flow
3 network. We can discuss this methodology in future
4 meetings. We had not planned on going into that at
5 this time.

6 The next slide, and we are on slide 59,
7 shows representative analysis results for a design
8 basis event and also a beyond design basis event. The
9 graph on the left shows the loss of off-site power but
10 without the additional failure assumptions included in
11 the beyond design basis analysis.

12 The graph on the right the analysis also
13 includes the loss of both diverse shutdown systems.
14 You can see in these graphs we show the boiling
15 temperature of the sodium coolant and also the
16 temperature at which the fuel would melt. You can see
17 by the curves that both the fuel temperature and the
18 coolant temperature were well below those values.

19 In all cases there continues to be a
20 significant margin to critical performance parameters,
21 coolant boiling and fuel melt. You can also see again
22 on the right the negative reactivity and the various
23 contributors to that reactivity. As I noted before
24 the net curve on the bottom, which is the sum of the
25 other contributors, it appears to keep going up at the

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1 right-hand side of the curve when, in fact, what this
2 curve does is asymptotically approach zero if you
3 carry it out far enough.

4 That's the last section we had, Don. Just
5 conclusions are left. We'll just finish the rest of
6 it.

7 Our conclusions then. The preliminary
8 design is complete. Extensive testing needed for the
9 design verification has also been complete and it is
10 noted we have additional testing identified to further
11 support our database of tests.

12 The 4S is considered to be a mature design
13 and by this we mean that it's based on many years of
14 design analysis and extensive testing that has been
15 performed and that is specifically for or is
16 applicable to the 4S reactor design. Toshiba and its
17 partners are requesting continued dialogue with the
18 NRC leading to 4S design approval.

19 We would like to leave you with this last
20 slide which again shows the schedule for future
21 meetings that we are suggesting. We are asking to
22 work closely together with the NRC staff to try to
23 come to an agreement on future meetings and document
24 submittals.

25 This concludes the Toshiba section of the

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1 presentation. We thank you very much for your
2 attention and would be happy to answer any questions
3 you have.

4 MR. CARLSON: Are there any members of the
5 technical staff of NRC who would like to ask any
6 questions? If so, please use the microphone.

7 MR. RUBIN: Stu Rubin, Office of Research,
8 Senior Technical Advisor for Advanced Reactors. Can
9 you tell me what the role is of probabilistic risk
10 assessment in developing your licensing basis? Is it
11 simply what is called upon in Part 52 as it would be
12 for light water reactors or do you use it to any
13 greater extent in defining AOOs design basis accidents
14 and beyond the design basis accidents?

15 MR. MAURER: The PRA is certainly used in
16 defining the accident sequences and the design basis
17 events and beyond design basis events. Does someone
18 from Toshiba want to add to that?

19 MR. SAKASHITA: And also you have the
20 criteria for the core damage for the analysis results
21 and also the PRA results. Also the event selection
22 and the PRA itself is provided for the license
23 application.

24 MR. RUBIN: Okay. For light water reactor
25 licensing traditionally kind of a deterministic

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1 engineering judgment is used for selecting design
2 basis accidents. Are you planning to do that but also
3 to utilize some PRA insights to either modify or to
4 supplement that list?

5 MR. SAKASHITA: Yes. We also look at the
6 deterministic analysis, the previous experience in the
7 PRISM or the Clinch River. Also we look at the PRA.
8 Both is considered in the event selection
9 determination.

10 MR. CARLSON: Imtiaz, go ahead.

11 MR. MADNI: Imtiaz Madni, Office of
12 Research. You mentioned that you have an analysis
13 called ARGO-3 and I presume that is used for both
14 design basis and beyond design basis calculations.
15 How about for hypothetical core accidents even though
16 you mentioned that none of the sequences that you have
17 selected to analyze have led to any core damage?

18 When you consider design submittals and
19 the NRC decides to review them and if they decide to
20 look at analysis of hypothetical core accidents would
21 you suggest that ARGO-3 be useful in that or you would
22 have to design a different code or use NRC codes or
23 what?

24 MR. SAKASHITA: At this moment ARGO-3 is
25 only for the transient NRC code so the ARGO itself

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1 can't analyze this or evaluate the core damage
2 sequence.

3 MR. MAURER: So a different code other
4 than ARGO-3 would have to be used.

5 MR. MADNI: Okay. Thank you.

6 MR. CARLSON: Any other questions from the
7 staff? Steve.

8 MR. BAJOREK: Just a couple of questions.
9 This is Steve Bajorek for Office of Research. When
10 you are talking about your test facility for future
11 tests can you give some indication on the scale that
12 you are talking about for the integral test facility?
13 This is in reference to slide 52.

14 MR. SAKASHITA: I see. No, I can only
15 answer the flow rate. The flow rate is about 10 cubic
16 meters per minute. That is almost the same flow rate
17 of the 4S reactor.

18 MR. BAJOREK: Okay. Are you saying that
19 this test is more or less full scale?

20 MR. SAKASHITA: Flow rate almost full
21 scale.

22 MR. BAJOREK: Okay.

23 MR. WRIGHT: Steve, I think in the sense
24 of integral testing the test facility they are
25 planning in Yokohama is a component test. They are

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1 talking about testing a steam generator tubes and also
2 EM pump, but I don't think they are anticipating using
3 that facility for an integral system test similar to
4 what we did in LWR.

5 MR. BAJOREK: Okay. Okay. So your plan
6 then would be to do the testing then on a component by
7 component basis. You really would not have any plans
8 to do a full integral facility. Is that correct?

9 MR. WRIGHT: Right.

10 MR. BAJOREK: Okay. One other question
11 with regards to the testing on page 46. You are
12 talking about your heat transfer test for the RVACS.
13 I just want to be clear. Did you run that in a forced
14 convection mode or was that run in natural convection
15 to be more passive?

16 MR. SAKASHITA: Here we are using a fan.
17 That means forced circulation. As for the number we
18 adjusted the fan to simulate the number for the
19 natural circulation.

20 MR. BAJOREK: Okay, but a natural
21 circulation you would really characterize that more
22 with the Grashoff or Rayleigh number and that is why
23 I'm a little bit interested in how you would apply
24 these forced convection tests to a natural circulation
25 system where depending on the scale, I mean, this

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1 looks like it's fairly large, and the resistances
2 throughout the flow circuit could give you something
3 considerably different than the information that you
4 have now.

5 MR. SAKASHITA: Your point is aggressive
6 number could be significant in the natural
7 circulation.

8 MR. WRIGHT: Steve, I wasn't involved in
9 these tests but I was involved in the containment
10 testing we did for AP-1000 and AP-600. We did a
11 similar thing. I mean, we couldn't build a full-scale
12 containment facility so in order to get prototypic
13 velocities we put a fan at the top in order to draw
14 the air through. We had similar arguments with the
15 staff over whether this was going to be representative
16 of a forced or free convection.

17 MR. BAJOREK: I remember the arguments at
18 the ACRS for containment scaling, too. That's why I
19 just wanted some clarification on what you had done
20 there. That's all. Thank you very much.

21 MR. SAKASHITA: Thank you so much.

22 MR. RUBIN: Stu Rubin again. In your
23 regulatory conformance analysis you went through and
24 looked at existing regulations, reg guides, standard
25 review plans. I was wondering if you could speak to

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1 the specific subject of control room and onsite
2 staffing and what generalized kinds of conclusions you
3 came up with and what you feel would be adequate for
4 this design.

5 The other question I would ask was a
6 statement made that Westinghouse was supporting
7 licensing in the United States. The question there
8 would be has there been any kind of interactions with
9 regulatory authorities in other countries? That would
10 be very helpful to know for NRC if there is any
11 opportunity to dialogue with other country's
12 regulatory authorities.

13 MR. SAKASHITA: At present we don't obtain
14 any licensing from the Japanese government so this is
15 the first try to obtain the license -- I mean, the
16 discussion about the regulatory issues. Four
17 operators is sufficient for the operation of 4S
18 reactor.

19 MR. RUBIN: So you're saying there is a
20 total of four on-site operational staffing with one or
21 two licensed among those four?

22 MR. SAKASHITA: Yes. You're correct.

23 MR. DUBE: Done Dube, Office of New
24 Reactors. Upon the double-walled steam generated
25 tubes with leak detection is there a fill gas in

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1 between?

2 MR. SAKASHITA: Helium.

3 MR. DUBE: Helium. And is the intent that
4 with the leak detection that if there were a leak up
5 through one tube that it would eventually be plugged
6 on a periodic basis immediately or that hasn't been
7 thought of yet?

8 MR. SAKASHITA: Immediately shut down and
9 plug it.

10 MR. DUBE: And is there an over design in
11 terms of the number of tubes beyond capabilities of 10
12 percent margin, 20 percent margin?

13 MR. SAKASHITA: You are correct.

14 MR. DUBE: Some percent like that. Is it
15 a possibility of steam generator replacement if it
16 ever were necessary or you are not planning on that?

17 MR. SAKASHITA: Yes.

18 MR. DUBE: The answer is yes?

19 MR. SAKASHITA: Yes, you are right.

20 MR. DUBE: Thank you.

21 MR. MIZUNO: Garry Mizuno, Office of
22 General Counsel for NRC. I have primarily regulatory
23 questions as opposed to technical questions as you can
24 probably imagine. I guess the first thing is that you
25 started out the presentation by saying you were going

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1 to seek design certification, but then your slides
2 actually say design approval and there is a
3 significant difference in terms of the regulatory
4 process and its implications. I guess I would like to
5 know which path Westinghouse is actually planning to
6 take.

7 MR. MAURER: I think the path right now is
8 toward design approval. I think since design approval
9 is one step to design certification that path might
10 change in the near future. Right now we are looking
11 at design approval.

12 MR. MIZUNO: Just as a matter of
13 clarification, the new Part 52 removes the need for
14 design approval as a prerequisite for design
15 certification so you do not necessarily have to get a
16 design approval to achieve design certification just
17 so that you know that. Okay.

18 Second question. Has Westinghouse and
19 Toshiba done a review and are prepared to give the NRC
20 a list of the regulations for which nonconformance
21 with the regulations will be needed with respect to,
22 I guess, in terms of an exemption or some other kind
23 of regulatory dispensation with respect to the 4S
24 design and whether you could give it to us in the near
25 future?

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1 MR. SAKASHITA: We have a discussion at
2 the third meeting and then --

3 MR. WRIGHT: There is regulatory
4 conformance here at the third meeting.

5 MR. MIZUNO: So I take it at the third
6 meeting there will be a list available or prior to the
7 third meeting?

8 MR. MAURER: Go ahead.

9 MR. SAKASHITA: After the third meeting
10 you will see our report and we want to submit the
11 report about regulatory conformance.

12 MR. MIZUNO: Okay. And that report will
13 not only identify the regulations but indicate what
14 would be the bases -- the alternative bases for
15 evaluation of the 4S design?

16 MR. MAURER: Yes, that's correct.

17 MR. MIZUNO: Okay. And from a regulatory
18 standpoint the industry in the past has opposed the
19 use of what we call applicable regulations as a
20 substitute for regulations which are not applicable to
21 a particular design. I know we've had this problem or
22 this issue come up with AP-600 and AP-1000.

23 Do you also plan with respect to the 4S
24 design that the design approval and any subsequent use
25 of that reactor in a particular combined license or

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1 construction permit would also not involve the
2 explicit definition of these alternative design
3 acceptance criteria or technical standards?

4 MR. MAURER: I'm not sure what your
5 question is. Could you restate it, please?

6 MR. MIZUNO: Yes. For example, let's just
7 assume that a particular GDC or a particular
8 regulation like ECCS system involving fuel cladding
9 interactions using 17 percent involving zirconium
10 based cladding. I do not believe those would be
11 applicable to the 4S design.

12 Presumably you would have to get an
13 exemption from that particular set of regulations. In
14 the past the staff has discussed with the industry the
15 need to establish and have explicitly stated, at least
16 in design certifications, alternative licensing or
17 technical standards that would apply in lieu of the
18 regulation which is not technically applicable.

19 Industry has opposed that by indicating
20 that the design is what it is. Since we are just
21 talking here about a design approval as opposed to a
22 design certification and its ultimate use in a license
23 without more, has Westinghouse thought about that
24 issue and whether there is going to be additional
25 regulatory time necessary in order to obtain closure

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1 on the development and use of these alternative
2 licensing criteria or technical criteria?

3 MR. MAURER: I don't know about the
4 additional time that would be required but as we
5 indicated in the presentation, a good number of these
6 requirements, the GDCs for example, about half of
7 those we determined were applicable to the 4S.

8 MR. MIZUNO: I'm not talking about the
9 ones that are applicable. I'm talking about --

10 MR. MAURER: I understand. I understand.
11 Then nearly the other half we obtained from the Clinch
12 River and the PRISM reviews which were the liquid
13 metal reviews. We also identified some additional
14 that were 4S specific. While we determined that some
15 were not applicable, we identified almost an equal
16 number in addition that are specific to liquid metal
17 and to the 4S.

18 MR. MIZUNO: But you are not allowing for
19 any additional time in your schedule to obtain NRC
20 staff and ultimately Commission approval of in
21 particular the ones that are most likely to result in
22 some schedule impact are the ones which are 4S unique
23 as opposed to ones which are drawn from our past
24 experience, especially with Clinch River which I was
25 involved with. Okay.

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1 MR. MAURER: At this time it's difficult
2 for us to foresee what that means in terms of the
3 overall schedule but hopefully working with the staff
4 we can better define what that is.

5 MR. MIZUNO: Okay. Assuming that we come
6 to closure, at least with respect to the applicable
7 technical requirements, we still need to deal with the
8 issue about whether you are going to actually
9 implement that alternative technical requirement in
10 what the staff has previously called applicable
11 regulations. I just raise that as an issue for you to
12 think about. Maybe we can talk about that at the
13 third meeting.

14 I guess my final question is with respect
15 to your identification of certain accidents including
16 the sodium water reactions as beyond design basis.
17 From the standpoint of regulatory treatment what is
18 your position, or what is the Westinghouse position
19 with respect to the regulatory implications of
20 treating an accident as beyond design basis?

21 MR. MAURER: I'm not sure of the answer to
22 that.

23 MR. SAKASHITA: For the sodium water
24 reaction our standard point is that we provide the
25 double boundaries and provide also the continuous

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1 monitoring system for one boundary failure. That is
2 our standard point for the sodium water reaction. If
3 the question is specific for the sodium water
4 reaction, this is my answer.

5 MR. MIZUNO: Well, I understand that you
6 consider the design -- I mean, the likelihood of a
7 sodium water reaction to be relatively low I assume,
8 but now you are defining it as being beyond design
9 basis.

10 I guess I would like to know from your
11 standpoint what implications do you expect in terms of
12 the NRC treatment of that whether in the review or the
13 approval where it's in subsequent use with respect to
14 its nature as a "beyond design basis accident?" Does
15 that have any implications with respect to how the NRC
16 is going to look at that or deal with that?

17 MR. SAKASHITA: We direct you review the
18 comment.

19 MR. MIZUNO: Well, yes. I mean, okay.

20 MR. WRIGHT: You agree that there is at
21 some point a limit to how low a probability is before
22 you go from beyond design basis to the design basis.
23 They are using that kind of criteria by making this a
24 very unlikely event.

25 MR. MIZUNO: Okay. Let's assume that, for

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1 example, with respect to sodium water interactions
2 that the NRC staff agrees with the Westinghouse
3 assertion that it is an extremely low probability and,
4 therefore, beyond design basis. The implications of
5 that NRC decision would be what in your mind?

6 MR. WRIGHT: Well, it would be -- I'm not
7 a liquid metal guy. I'm talking from --

8 MR. MIZUNO: I'm talking about from a
9 regulatory standpoint because I presume they would
10 still end up having to have features and treatment of
11 whatever parts of the material and whatever systems
12 that would ultimately result in the NRC -- what would
13 form the basis for the NRC staff's determination that
14 something is extremely low probability.

15 Usually that means they are going to be
16 considered safety related and we are going to have the
17 full set of Appendix B kinds of things applied to that
18 and certain other what I would call special treatment
19 requirements applied. Apart from that what would be
20 the regulatory implications? Is there any reason to
21 assign these things or to delineate these things as
22 beyond design basis from your standpoint?

23 MR. MAURER: Well, I think they are
24 identified as beyond design basis because of the
25 number of assumed failures in the accident sequence.

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1 As far as the consequences, I think we have shown that
2 the consequences of these events still fall within the
3 design basis of the plant.

4 MR. MIZUNO: Okay, but I'm trying to
5 determine not consequences in terms of what a
6 technical person would talk about but I'm talking
7 about what would be its effect of treating something
8 as beyond design basis upon the NRC's regulatory role,
9 I guess, or its treatment of that particular design
10 accident, I guess? Again, you can save this for the
11 third meeting maybe.

12 MR. MAURER: I would like to ask Dr. El-
13 Sheikh to respond to your question.

14 MR. EL-SHEIKH: My name is Kamal El-Sheikh
15 from Cameron Consulting International. I have done
16 some work for Toshiba in the regulatory conformance
17 area. I suppose your questions are related to risk
18 informed decision.

19 MR. MIZUNO: Could be.

20 MR. EL-SHEIKH: As to how the NRC would
21 decide, it's the weight of the evidence that would be
22 provided that in terms of the equipment, in terms of
23 the lines of defense, in terms of the data, in terms
24 of the level of confidence in the risk that would be
25 done.

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1 As far as the process actually in
2 determining the design basis and the beyond design
3 basis I supposed that there was a grouping based on
4 the probability of a group of events, some class of
5 events. There were determined that the damage, the
6 cumulative damage, fraction or factor of the fuel
7 would be below a certain limit so that it can survive
8 with very high level of confidence for 30 years.

9 As you have more serious events, then you
10 would confine, for example, the public consequences to
11 10 CFR 20 and so on. When you get to the beyond
12 design basis it is something that would be in the
13 range, I suppose, of less than 10 to the minus X. Let
14 me put it this way at this point.

15 For that we try to look at the criterion
16 for the release. You want to have the containment
17 function. You have to have the exposure of the public
18 minimized. These areas would be defended on the basis
19 of evidence that would be shown there. In there would
20 be data about sodium leaks and so on. I wonder if
21 that answers your question.

22 MR. MIZUNO: That just goes to the defense
23 of that particular accident being of relatively low
24 probability. I mean, to help you out, to give you an
25 example, if something is determined to be of a

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1 relatively low probability so that we call it beyond
2 design basis, does that mean, for example, that
3 Westinghouse is going to say that any additional
4 mitigation measures whether they be procedural design
5 would not be necessary as a matter of course?

6 MR. EL-SHEIKH: Of course there would be
7 some that are like that and some you might say we
8 don't have that much confidence or a decision is made
9 that you want to put another level there. I think
10 these issues have to be dealt on a case-by-case basis.

11 MR. MIZUNO: Okay. So you are going to be
12 using a risk-informed approach which means you are
13 going to look at defense-in-depth, diversity, those
14 factors apart from -- calling it beyond design basis
15 doesn't necessarily in your mind result in an explicit
16 cutoff of regulatory control over those matters?

17 MR. EL-SHEIKH: Not necessarily. I think
18 this is the area really where concurrence of NRC with
19 the decision is very important and is critical to move
20 on. I think these are the areas which the decision
21 has to be made and it is in this area that interaction
22 with NRC would be highly desired.

23 MR. MIZUNO: Okay. I guess that sort of
24 leads on to another question which is we have been
25 primarily focusing on design here. I can see that

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1 some of these determinations may result or have an
2 impact upon the applicability or nonapplicability of
3 operational requirements.

4 In particular I'm thinking about emergency
5 preparedness and also operator licensing requirements.
6 I'm just wondering again maybe just as a preview for
7 the third meeting has Westinghouse thought about the
8 implications of its design on operational requirements
9 and even further on to decommissioning?

10 To put it one way, if the Westinghouse
11 position is that there are never going to be under any
12 possible circumstance any releases exceeding Part 100
13 at the site boundary, conceivably that could be a
14 basis for a determination that no emergency
15 preparedness or an extensively truncated set of
16 emergency preparedness requirements would be
17 appropriate for the 4S reactor even after considering
18 a risk informed approach where you are looking at
19 defense-in-depth.

20 I'm just wondering, again, have you gone
21 through that process of looking just beyond the design
22 to see how this thing might be utilized in a licensing
23 scheme with an operating reactor.

24 MR. MAURER: I think at this point we will
25 need to defer the answer to that question until a

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1 subsequent meeting.

2 MR. MIZUNO: Okay. Sorry. One more
3 question. I forgot about this. Again, we are
4 focusing on design from a safety standpoint. Has
5 Westinghouse done a severe accident mitigation
6 analysis, a SAMO/SAMDA analysis to assist the NRC in
7 a NEPA evaluation of the design?

8 We will either do one -- well, ultimately
9 they have to do one in any event as part of a license
10 that actually will use this reactor. Depending upon
11 whether you choose design approval or design
12 certification, what you ask us, we might also have to
13 do it at that stage.

14 PARTICIPANT: Not off hand.

15 MR. SAKASHITA: We have conducted a
16 preliminary PRA. We have conducted preliminary PRA
17 and the PRA results shows the probalistic or the
18 probability of the core damage is very small so we
19 didn't analyze it. We can show this kind of issue
20 including the defense-in-depth at the second meeting.

21 MR. MIZUNO: Okay. I think I understand
22 the theory now that Westinghouse may use at the NEPA
23 for purposes of NEPA compliance.

24 MR. RUBIN: Stu Rubin again. Just to push
25 a little more on the question of how the PRA is used,

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1 if you go back to the PRISM review the staff asked the
2 Commission if it would be okay to take a certain
3 approach in establishing the license bases for PRISM
4 and to succinctly say it was to use PRA to supplement
5 a basic deterministic approach. There was a limited
6 application of PRA in PRISM.

7 More recently if you come forward into the
8 current day, some of the non-light water reactors want
9 to take even greater use of PRA in establishing the
10 licensing basis. The HGGR community, for example,
11 wants what we have come to call a fully risk informed
12 approach to establishing licensing basis events, AOOs,
13 EBAs, BDBAs.

14 In 2003 we asked the Commission if it
15 would be okay to establish licensing basis making this
16 fully a greater use of PRA and the Commission said
17 that would be okay but you had to use engineering
18 judgment to bound the uncertainties in the PRA. I
19 guess where we are looking to get better understanding
20 is where between those two approaches are you? Are
21 you still back in the days of the PRISM concept of
22 using PRA to supplement a basic deterministic approach
23 to establishing the licensing basis or you really
24 wanted to make much greater use of the PRA?

25 The further you go in using the PRA to

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1 establishing the licensing basis events, the special
2 treatment requirements, defense-in-depth and so forth,
3 you will create a policy question on the part of the
4 staff that we need to get decisions from the
5 Commission and so these will take time to package
6 these issues, to establish options, to make
7 recommendations, and hopefully get approvals if you
8 are moving further into making greater use of risk.

9 I would suggest as part of the Phase III
10 we get a good look and understanding of how much you
11 want to use the PRA. To the extent you get far into
12 greater use, the whole quality and completeness of the
13 PRA becomes a subject unto itself and how you use it
14 is other subjects. Just a comment we like to
15 understand that.

16 MR. SAKASHITA: Thank you for your
17 suggestion.

18 MS. HULL: Amy Hull, Office of Research,
19 Materials Engineering. I would like to have more
20 understanding of your perception of the issues
21 associated controlling the compatibility between
22 coolant and structure. It has been my experience that
23 it is not only the material selection. HT-9 and 9 CR-
24 1 Mo there's a fair database on that but there are
25 also issues associated with the purity of the liquid

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1 metal so I have questions concerning your sodium
2 volume.

3 I have questions about how you are going
4 to do the online monitoring if there have been major
5 evolutionary changes since the last technology that
6 was used. I have questions about your purification
7 system. I have experience working with EM pumps and
8 having some problems previously with clogging because
9 of some nonmetallic issues.

10 With your new sodium test facility I have
11 questions about the specifications there in terms of
12 relative scale -- you know the scale compared to what
13 you expect in the 4S, your flow velocity, your volume,
14 your monitoring technology, your purification testing.

15 Can you either today or later provide more
16 information about corrosion compatibility issues from
17 a material sciences perspective. Also, my testing
18 previously with liquid metal corrosion you can have
19 variability almost within heat of HT-9 and modified 9
20 CR-1 Mo.

21 MR. SAKASHITA: Thank you for your
22 comment.

23 MR. MADNI: Imtiaz Madni again. You did
24 indicate in your design you have helical tube coils in
25 the steam generator. They are doubled-walled with

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1 helium inside and this seems to have been the approach
2 taken by PRISM as well.

3 In more recent discussions related to GNEP
4 I think the tendency is to go towards single-wall
5 tubes as opposed to double wall primarily because of
6 efficiency. When you have a double-walled tube with
7 helium in between, there's got to be some sacrifice in
8 heat transfer. I was wondering if you looked at that
9 and what would be the sacrifice in terms of efficiency
10 that you would be willing to take or that you expect
11 to take to get the better safety from the design.

12 MR. SAKASHITA: Actually, there is a
13 tendency to make them extensive. Quantitatively the
14 deduction rate is about 20 percent or something like
15 that because of the helium and the wire mesh between
16 the outer tube and the inner tube so heat transfer
17 reduction is not so much.

18 MR. MADNI: Twenty percent reduction?

19 MR. SAKASHITA: About. Almost. About 20
20 percent.

21 MR. MADNI: So you are losing 20 percent
22 of your efficiency because of double wall.

23 MR. SAKASHITA: That is kind of a
24 sacrifice but we selected the double tube.

25 MR. MADNI: Single tube versus double tube

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1 you would have a difference of 20 percent?

2 MR. SAKASHITA: Heat transfer efficiency
3 at least by 20 percent.

4 MR. MADNI: I need to look at this again.

5 MR. MATZIE: It's not 20 percent reduction
6 in efficiency of the plant. It's of a parameter.

7 MR. MADNI: This is a very key parameter
8 in the efficiency of the plant because whatever heat
9 you transfer from the primary to the -- I mean, from
10 the intermediate transport system to the steam
11 generator system, that's what is going to be used to
12 generate electricity or generate power. If there is
13 a 20 percent reduction in the heat transfer co-
14 efficiency, you are going to get a substantial
15 reduction in efficiency

16 MR. WRIGHT: Yes, but you would make up
17 the 20 percent reduction. You would just have more
18 tubes or increase length of the tube 20 percent to
19 offset the difference in the heat transfer.

20 MR. MADNI: You're not really going to
21 reduce the efficiency. You are just going to
22 compensate for it by having more tubes or longer
23 tubes.

24 MR. WRIGHT: That's right.

25 MR. DUBE: Don Dube, Office of New

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1 Reactors again. On page 57 on beyond design basis
2 events there is a statement that says, "Preliminary
3 results show that no sequence has identified the
4 results of core damage."

5 Up above under the list of beyond design
6 basis events is listed IRACS failure and loss of
7 partial function of RVACS. I'm presuming if I read
8 between the lines that if one were to have a loss of
9 normal cooling versus the steam generator cooling and
10 loss of all IRACS and loss of complete function of
11 RVACS so that might be a possible core damage
12 sequence.

13 MR. EL-SHEIKH: Kamal El-Sheikh from
14 Cameron Consulting International. Of course, if you
15 track all the capability through the heat it would
16 lead to core damage regardless of what reactor we're
17 talking about. The likelihood of this to happen is
18 extremely low.

19 The accident that was recognized was a
20 partial blockage of RVACS and I don't recall how much
21 blockage was there but one could assume you lose all
22 heat remover capability. If that happens, yeah, it
23 will heat up everything and that takes care of that in
24 the structures and all of that. In fact, we try to
25 find sequences but be reasonable in selecting these

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1 sequences.

2 I mean, one would have to look at the
3 mechanisms by which one can read to these I suppose.
4 The list that was selected that was shown here
5 actually there is a lot of work that went into it in
6 terms of variable effects analysis, full trees, event
7 trees, and all the rest. Some of the assumptions
8 actually are not mechanistically driven. It was
9 assumed as reasonable.

10 MS. TENE: Hi. I'm Kimberly Tene with the
11 Office of Research. I have probably some more basic
12 questions. I noticed that in your overview you said
13 that it's a 30-year recycling or before you need to
14 replace the fuel is 30 years. Does that mean that is
15 your plant life or are you trying to get a plant life
16 that is 60 years or something like that?

17 MR. SAKASHITA: Plant life time in
18 subyears.

19 MS. TENE: So once the -- so what you're
20 saying is that you will never refuel these plants?

21 MR. SAKASHITA: You are correct.

22 MS. TENE: Okay. So at end of life for
23 the plant, are you then assuming that the fuel stays
24 at the plant or are you then looking at -- have you
25 looked at the long-term storage? Do you know how that

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1 transport happens, that sort of stuff?

2 MR. SAKASHITA: Long-term storage.

3 MS. TENE: And you have -- it would follow
4 the similar storage mechanisms for the light water
5 reactor plants, the transport?

6 MR. SAKASHITA: Yes. After one year
7 cooling the spent fuel will be transported to the
8 long-term storage.

9 MS. TENE: And during that one-year
10 cooling will the plant need to continue to cool? Will
11 you still need the sodium pumps active, the liquid
12 metal pumps, or will it be --

13 MR. SAKASHITA: Natural convection is
14 sufficient for the spent fuel cooling.

15 MS. TENE: Okay. Thank you.

16 MR. RUBIN: A question that relates to the
17 life time and life expectancy of the plant. The
18 question is really the time or the periodicity of
19 conducting any in-service inspections, in-service
20 testing. One of the general generic concerns for
21 plants that have online refueling are very long
22 refueling periods is it stretches out the times and
23 you can actually go in and look at components and
24 degradation and so forth.

25 One of the ways you build confidence in

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1 your PRA as those degradation mechanisms are
2 understood is to have inspection programs that
3 periodically take a look at testing.

4 Do you have anything you can say about
5 what the periodicities will be, what kind of
6 inspection or testing activities you will have over
7 the life of the plant to be able to gain confidence
8 that materials are performing as expected and
9 structures are performing as expected and so forth and
10 will that be a subject of the regulatory compliance
11 phase?

12 MR. SAKASHITA: Thank you for your
13 comment.

14 MR. EL-SHEIKH: Yes. I just want to add
15 one remark on the situation where you choke the
16 reactor completely. For that reactor if you look at
17 the thermal capacity of the sodium it would take days
18 at the level of great heat to evaporate the sodium.

19 It takes another two hours or so for the
20 light water reactors but you have at least -- if you
21 have a degradation, serious degradation of RVACS and
22 the heat remover system, you would have quite a bit of
23 time to recover from that. The thermal capacity is
24 really an element of safety there that I just wanted
25 to add in this remark.

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1 MR. SAKASHITA: I just want to say here
2 that we are looking at the ASME.

3 MR. BAJOREK: Maybe I missed it. I
4 haven't seen anything on the containment. During an
5 accident over a longer period of time you are dumping
6 decay heat into the containment atmosphere. What is
7 your heat sink beyond that? How do you remove that?
8 What type of air temperatures do you achieve in the
9 containment following one of these events?

10 MR. SAKASHITA: As for the cooling of the
11 containment vessel is the RVACS using the natural
12 draft and the containment vessel of the core vessel
13 and it is cooled by the air as for the temperature.

14 MR. BAJOREK: So in your containment
15 building regardless whether it's above grade or below
16 grade you are still going to be relying on air cooling
17 of the containment shell to achieve ultimate decay
18 heat removal. Have you looked at the effects of above
19 ground versus below grade?

20 I think that is one of the design features
21 that you are looking at. Of course, if it's below
22 grade it doesn't seem like it would have that much
23 surface area to be able to remove that decay heat. In
24 the preapplication are we going to see some of the
25 containment parameters, containment performance?

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1 MR. SAKASHITA: Yes, design verification.

2 MR. CARLSON: I don't believe we heard
3 anything about operational monitoring, in-core
4 detectors, out-of-core detectors. Have those been
5 considered as part of the design?

6 MR. SAKASHITA: You mean the safety?

7 MR. CARLSON: Operational monitoring to
8 confirm that the plant is operating within an expected
9 set of conditions.

10 MR. SAKASHITA: We have a detection system
11 for the reactor temperature and the voltage of the EM
12 pumps.

13 PARTICIPANT: Excuse me. On the phone.

14 MR. CARLSON: Yes?

15 PARTICIPANT: I can't understand the
16 answers that are being given.

17 MR. CARLSON: We should use the
18 microphones a little better. Thank you for pointing
19 that out.

20 Can you repeat your answer then?

21 MR. SAKASHITA: We have a system for the
22 plant heat systems such as reactor outreach
23 temperature, the mutual inspection, and the voltage of
24 the EM pumps, those kind of things.

25 MR. CARLSON: Thank you. I had another

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1 question on the 30-year life of the fuel. My
2 understanding is that this fuel will operate or will
3 be present in the core under core operating pressures
4 and temperatures in particular, the high temperatures,
5 for 30 years. Are you providing data to show that the
6 fuel, the cladding will operate within a given range
7 of conditions for that 30-year period?

8 MR. YACOUT: Abdellatif Yacout from
9 Argonne. We don't have an operating data for 30
10 years. However, from the very low or the benign
11 design of the fuel we are expecting that the fuel will
12 last this long. This is really all about how much
13 stress the cladding is exposed to and what are the
14 heat properties of the fuel and what are the
15 temperatures.

16 From our experience was the cladding materials
17 EBR-II FTF. We are not expecting that -- we are
18 expecting that the fuel will last for this period of
19 time but there hasn't been specific like 30-year
20 testing in the reactor.

21 MR. CARLSON: Thank you.

22 MR. YACOUT: That's what I was referring
23 to that the burn-up is very low. I mean, we test it
24 for 20 percent or 18 percent burn-up. This fuel is
25 going to last only for 4 percent or 5 percent burn-up

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1 so burn-up is --

2 MR. CARLSON: So you feel that you have
3 enveloped burn-up and you think you can make arguments
4 based on testing and models that --

5 MR. YACOUT: Based on testing and models
6 and existing database.

7 MR. CARLSON: That the 30-year performance
8 of the materials is adequately understood?

9 MR. YACOUT: Yes.

10 MR. CARLSON: Thank you. Building on the
11 earlier question that Kimberly raised, you indicated
12 that at the end of the 30-year lifetime and when you
13 are at least one-year cooling thereafter, the fuel
14 will be removed from the reactor and transported to
15 some interim storage facility?

16 MR. SAKASHITA: Yes.

17 MR. CARLSON: So that means you will be
18 opening the vessel at that point and removing the fuel
19 and putting those into a special transport package.
20 Is that correct?

21 MR. SAKASHITA: Yes. You are right.

22 MR. CARLSON: In terms of getting the fuel
23 to the site from the fuel fabricator, will you be
24 shipping individual fuel bundles or a complete core?
25 Have you analyzed how that will be done?

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1 MR. SAKASHITA: We are using the cask for
2 all of the 18 sub-assemblies apart from the vessel but
3 all of the sub-assemblies in dry cask.

4 MR. CARLSON: And those will be loaded
5 into the reactor vessel onsite?

6 MR. SAKASHITA: Onsite, yes.

7 MR. CARLSON: Thank you.

8 MR. SAKASHITA: For the loading we load
9 each sub-assembly one by one.

10 MR. CARLSON: Thank you. Well, we are
11 scheduled for another break. We could take it now and
12 see if there are anymore questions afterward and then
13 start moving toward wrap-up and the public comment
14 period. Shall we break for 15 minutes and come back
15 at 4:00.

16 (Whereupon, at 3:43 p.m. off the record
17 until 4:03 p.m.)

18 MR. CARLSON: Okay. The next part of the
19 agenda is discussion and next steps. As part of the
20 discussion if there were any lingering questions from
21 the staff, then we can resolve those and then move on.

22 MS. HARDIN: I had a follow-up question to
23 your question, Don. I'm Kim Hardin. I'm in Spent
24 Fuel Storage and Transportation. My question has to
25 do with, of course, transportation. I think the

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1 answer to Don's question was that you plan to put the
2 entire core in one transportation package?

3 MR. SAKASHITA: Put all fuel assemblies.

4 MS. HARDIN: And is that for both the
5 fresh and irradiated fuel?

6 MR. SAKASHITA: Yes.

7 MS. HARDIN: And we don't currently have
8 any certificates for that so are you planning to come
9 in and apply for certification of a package with that
10 design?

11 MR. SAKASHITA: Yes, I think so.

12 MS. HARDIN: Okay. I just wanted to give
13 you a little bit of advice. 10 CFR Part 71 has very,
14 very stringent and specific requirements for
15 transportation in both contents and the packaging
16 because you will be on public roadways.

17 I would pay close attention to 7155
18 criticality safety requirements and our guidance
19 documents and pay very close attention to some of that
20 before you come into apply for that certificate.

21 MR. SAKASHITA: Thank you.

22 MR. HARDIN: My name is Roy Hardin. I'm
23 with New Reactors. I have a quick question. I didn't
24 see anything really talking about instrumentation and
25 control systems, control and operations, etc. I'm

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1 wondering when we might be seeing something about that
2 in one of these meetings or is that something further
3 down the road?

4 MR. SAKASHITA: The control room is
5 located beside of the tibon buildings.

6 MR. HARDIN: We have a discussion about
7 the instrumentation control, the software and the
8 hardware systems, applicability to 603 standards,
9 information like that. That's what I would be
10 interested in seeing more information about regulatory
11 compliance of your control room software and hardware.
12 Will there be any discussion of that in any of the
13 further meetings?

14 MR. SAKASHITA: I understand. Thank you.

15 MR. HARDIN: Thank you.

16 MR. CARLSON: Okay. If there are no more
17 questions from the staff, we can move into the
18 discussion of next steps. As you've indicated in your
19 presentations, you proposed moving into a phase I
20 which actually started with this meeting consisting of
21 a series of meetings. You could put that up to help
22 us discuss that.

23 Your proposed phase I activities the next
24 step would be a meeting in, say, early December, late
25 November, and a third meeting sometime in January and

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1 a fourth meeting sometime in February. I guess my
2 first question on that is you would consider the staff
3 effort in participating in this phase I. Would that
4 consist of largely attending the meetings or would you
5 expect additional homework, say, outside the meetings?

6 MR. MAURER: I think at this point, Don,
7 the staff involvement is envisioned in those meetings
8 as more of an attendance basis. We would provide, of
9 course, the meeting materials beforehand but I think
10 material for detailed NRC review would be provided in
11 the form of technical reports.

12 MR. CARLSON: And that you indicated would
13 be phase II.

14 MR. MAURER: Right. That will occur
15 throughout 2008.

16 MR. CARLSON: So we will have to get back
17 to you on whether we can accommodate the series of
18 meetings that you propose.

19 MR. MAURER: Yes. Thank you.

20 MR. WRIGHT: Would you like us to request
21 these in writing? Would that be good or --

22 COURT REPORTER: Speak into the
23 microphone.

24 MR. WRIGHT: I'm sorry. I was just asking
25 if NRC required us to request these subsequent

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1 meetings in writing. Is that usually the way it's
2 done? We did this one, for instance.

3 MR. JOLICOEUR: I don't think it would be
4 necessary to directly request them in writing that
5 way. You have provided us information that you want
6 to hold these meetings. We will need to get back to
7 you in terms of whether or not we will be able to
8 support the schedule you have laid out. The bigger
9 challenge for us is going to be the schedule you have
10 laid out for phase II.

11 MR. CARLSON: Okay. So we will take it on
12 ourself to get back to you on the phase I proposal.
13 Did anyone want to discuss anything more about phase
14 I?

15 MR. WRIGHT: I'll say I know Toshiba and
16 Westinghouse is aware of the constraints on the NRC as
17 far as the ability to provide support and resources
18 for this so we would like to work together to come up
19 with something that is mutually for both of us. I
20 think this is just something we put out as something
21 we would like to do but we understand that you guys
22 and us will work together to come up with the right
23 dates for these kind of things.

24 MR. JOLICOEUR: I understand that we have
25 a number of preapplications underway at this time and

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1 this is one of them and, frankly, we have one, two,
2 three in-house in our branch right now. Only one of
3 them is actually budgeted for this year because it's
4 an ongoing event. The others are ones that were not
5 anticipated so, therefore, weren't in budget planning
6 except for in your case there is a small amount of
7 personnel budgeted just to track what was going on
8 because we had an ongoing preliminary discussion.

9 We have some internal discussions we have
10 to go through concerning all of this including the
11 DOE, the GNEP, and all the other impacts and figure
12 out we can support and what level we can support all
13 those activities. We'll have further discussions on
14 that.

15 MR. RUBIN: Don, I would just like to make
16 a suggestion. I know this is the project planning
17 phase we're in here but it's always good to look
18 forward to the actual topics that you would like to
19 staff the review without any promises that we would
20 have resources to meet the schedule but to know what
21 those topics are that you want to review so we can see
22 if your phase I activities seem to match up in a good
23 way which we can give you some specific feedback and
24 make sure we have the right people here in phase I
25 because we know what is coming in phase II.

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1 I don't know if you can kind of keep it in
2 a box on phase II. That has to help inform us on what
3 is going to be right in phase I and who are the right
4 people to sit in on phase I. To the extent you can
5 give us your list of topics just so we know and we can
6 think about that without any promises, that would help
7 us sort through phase I, I think, as well.

8 MR. CARLSON: Well, the next slide showed
9 phase II. Is that what you are referring to, Stu?
10 Slide 15.

11 MR. RUBIN: No. I think I have heard some
12 things today that we have to consider that aren't
13 listed in that list. Let me just put that up right
14 now.

15 MR. CARLSON: Slide 15.

16 MR. WRIGHT: Okay. Thank you.

17 MR. CARLSON: Did you want to get back up
18 on the mic? Get back to the mic, please.

19 MR. RUBIN: I guess my suggestion would be
20 to revisit that and develop maybe what your final
21 proposal would be of topics and then give us that and
22 then we could see what makes sense for phase I given
23 that is where you would like to go. We would have an
24 opportunity to think about what we might want to add
25 knowing what have been the regulatory issues for non-

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1 light water reactors in the last five years.

2 MR. CARLSON: That does bring in a more
3 direct discussion of what we can do under phase II.
4 That clearly is more than bringing a handful of staff
5 to a meeting. You are going to be submitting actual
6 reports and if we go by past practice there would be
7 requests for additional information, perhaps a
8 technical exchange meeting as part of that.

9 MR. RUBIN: We anticipate that.

10 MR. CARLSON: At some point some final
11 product by the staff from the review of those
12 documents. Have you envisioned what that final
13 product would be for each of these technical reports?

14 MR. JOLICOEUR: Recognize that right now
15 we do our preapplication reviews for advanced reactors
16 and non-light water reactors in the Office of
17 Research. The Office of Research doesn't issue SERS
18 per se. In our current practice, for example, with
19 EBMRs we have already gone through -- we have four
20 White Papers in-house we have provided, a preliminary
21 meeting, a set of RAIs. We are waiting for responses.

22

23 Once we get those responses we intend to
24 provide them with a final conclusion on that, a
25 document that gives them our final conclusions in that

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1 paper. I wouldn't be a safety evaluation report but
2 would be our conclusions on those White Papers.

3 MR. CARLSON: In some regards the
4 conclusions would be more like status reports, where
5 we stand on the various issues but we would give you
6 some final product.

7 MR. WRIGHT: Okay. Obviously we are
8 looking for something that is going to allow us to do
9 a submission of a DCD type of thing at a later date.
10 That would be what we would hope to get, guidance from
11 you as to how that would look.

12 MR. CARLSON: And building on what John
13 said about some of the resource constraints that we
14 will ultimately face and what Stu is saying about
15 revisit some of your topics, perhaps it would be in
16 your interest to prioritize these reports during phase
17 II. Or if you were required to come up with a
18 smaller set of reports initially what would those be.
19 Yes, recognizing that the staff may have difficulty
20 addressing everything you are asking for because of
21 resource constraints and availability of key staff.

22 Anything else that anybody would like to
23 bring into the next steps discussion?

24 MR. ROSENFELD: Don, are you taking
25 questions from the public yet?

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1 MR. CARLSON: You beat me to the punch
2 but, yes, that is the next step now. We are now
3 opening it up for public comment. We have people both
4 on the phone and people in person so we will alternate
5 phone and person.

6 MR. ROSENFELD: This is Rob Rosenfeld on
7 the phone.

8 MR. CARLSON: Rob Rosenfeld wants to speak
9 first. Is that okay? Okay. Rob, go ahead.

10 MR. ROSENFELD: Thank you very much. I
11 really appreciate everybody coming together today and
12 sharing all the important information that has been
13 shared. My name is Rob Rosenfeld. I work with the
14 Yukon River Inter-Tribal Watershed Council. The Yukon
15 River Inter-Tribal Watershed Council was formed in
16 1997.

17 It's a treaty organization of 13 first
18 nations, governments in Canada, and 53 tribes in
19 Alaska. The 66 tribes and first nations come together
20 once every two years for a full board meeting. I'll
21 talk just -- I'll keep it brief. A couple of
22 questions which at some stage would be very good to
23 have answered. It doesn't have to be right now.

24 One question that is always lingering that
25 is asked over and over is with regards to storage.

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1 What storage solution will there be after the
2 radioactive material -- after the reactor is finished
3 operating after 30 years. The other question that
4 comes up fairly regularly is the very low temperatures
5 often exceeding minus 50 degrees below for extended
6 periods of time.

7 We would like to make sure that whatever
8 design is considered is suitable for a climate of this
9 temperature. Also in the design we would like to
10 bring up the fact that a fault line is very nearby
11 where the reactor has been discussed as far as
12 placement goes.

13 Lastly, as far as other concerns or
14 questions to address at a future date is the fact that
15 permafrost is melting in Alaska at a rapid rate so the
16 integrity of the ground in many locations is not
17 dependable so it is important to have permafrost
18 experts that can determine the rate at which
19 permafrost is melting, look at any sites that are
20 being considered. Those are just a couple of
21 questions.

22 I just want to make a couple of very quick
23 comments. The full board of directors of the Yukon
24 River Inter-Tribal Watershed Council has met in 2005
25 and 2007 and they have accomplished a consensus vote

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1 which opposes the transport of radioactive materials
2 on the Yukon River Watershed, the storage of
3 radioactive materials on the Yukon River Watershed,
4 and the experimentation with radioactive materials on
5 the Yukon River Watershed.

6 The resolution actually also states that
7 the tribes are opposed to the 4S sodium cooled
8 reactor. That is for the record. I wanted to have
9 that stated.

10 Also, there is an organization called the
11 Tanana Chiefs Conference which represents 42 tribal
12 governments in the interior of Alaska, all Athapaskan
13 tribes. They voted, I believe it was also in 2005, in
14 opposition to this proposed reactor. I wanted to make
15 sure Toshiba and Westinghouse was well aware of the
16 local opposition.

17 We have received directives from the
18 International Executive Committee that serves the
19 board to go to Japan and speak with the Japanese DIA
20 to talk about Toshiba's intent to put a reactor in a
21 place where 66 indigenous governments from two
22 countries are opposed so that trip is in the planning
23 stages.

24 We have also been asked to put ads and
25 opt-ad pieces in the New York Times and we've been

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1 asked to go the United Nations to bring life to the
2 ongoing disregard for the wishes of the tribal
3 governments on the Yukon River Watershed.

4 We have sent letters to Toshiba expressing
5 the opposition and we've gotten no response. At this
6 stage I would like to invite Toshiba to contact myself
7 and I would be happy to organize dialogues with the
8 tribes on the Yukon River Watershed. Again, I
9 appreciate all your time and I do hope that in your
10 exploration of trying to find energy solutions for
11 tomorrow that you can find a remote area which doesn't
12 sit on an international water body.

13 The Yukon River is an international water
14 body. There are many treaties. I would draw your
15 attention to the 1909 Transboundary Water Treaty and we
16 have gotten many, many calls from Canadian government
17 officials that are already expressing opposition. I
18 do hope that you can find a remote place that won't be
19 as volatile as far as opposition goes. I hope that
20 you can come up with a solution that works towards
21 coming up with energy solutions for the future. Thank
22 you for your time.

23 MR. CARLSON: Okay. Does anybody want to
24 provide another comment?

25 PARTICIPANT: Yes, on the phone.

1 MR. CARLSON: We're going to alternate
2 between phone and people here in person if that's
3 okay.

4 Paul.

5
6 MR. GUNTER: Hi. My name is Paul Gunter.
7 I'm with Beyond Nuclear. A couple of questions. In
8 going over the model outside could we get some
9 clarification if there are valves on the hot leg to
10 the steam generator in the current design? If so,
11 what kind of valves they are.

12 MR. CARLSON: I believe that's a question
13 addressed to Toshiba and Westinghouse.

14

15 MR. GUNTER: Is it possible to get some
16 sense?

17 MR. WRIGHT: It's a pool reactor so there
18 is no hot leg per se. You are talking about --

19 COURT REPORTER: Talk into the mic,
20 please.

21 MR. WRIGHT: I'm sorry. It's a pool
22 reactor so there is no hot leg per se. You are
23 talking about the intermediate heat transfer loop. Is
24 that right?

25 MR. GUNTER: Yes.

1 MR. WRIGHT: They want to know if there
2 are valves on the piping coming out of the reactor
3 vessel go to the steam generator.

4 MR. SAKASHITA: No.

5 MR. WRIGHT: I guess the answer there is
6 no.

7 MR. GUNTER: Okay. Again, we are still
8 educating ourselves about this design but it would
9 seem to raise questions about isolation of the
10 reactor.

11 MR. SAKASHITA: You mean containment
12 isolation?

13 MR. GUNTER: Yes.

14 MR. SAKASHITA: Containment isolation
15 valve is located at the water and steam systems. The
16 containment boundary is expended to the isolation
17 valve in the water and steam loop.

18
19 MR. GUNTER: It would be helpful to see
20 that as a diagram. I haven't seen that yet.

21 MR. SAKASHITA: We can provide such kind
22 of information at the second meeting.

23
24 MR. GUNTER: Okay. In earlier
25 communications we saw from Toshiba it's my

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1 understanding that you intend to ship the high-level
2 radioactive waste in the vessel whole back to Japan.
3 Is that still your plan? We have documentation of
4 communication that Toshiba -- the plan was to send the
5 encapsulated waste back to Japan for interim storage
6 or reprocessing, whatever your plan is at that point.
7 Is that still your plan?

8 MR. MAEKAWA: We have not yet decided what
9 to do with the spent fuel.

10 MR. GUNTER: Right, but it was in earlier
11 communications. Correct?

12 MR. SAKASHITA: Toshiba never communicated
13 about such kind of thing.

14 MR. GUNTER: Thank you. I guess this
15 question is for the NRC. Given this novel -- let's
16 call it a novel approach to 30 years of operation
17 without maintenance, does the NRC consider that it has
18 a database that it has confidence in for addressing
19 cracking and corrosion mechanisms with this particular
20 kind of operation and susceptible materials?

21 I mean, do you have confidence given that
22 we have never really come across a proposal to operate
23 a reactor for 30 years without maintenance of internal
24 components and the issue of material susceptibility.
25 Do you sense that you have a level of confidence to

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1 address potentially unknown or known cracking and
2 corrosion mechanisms?

3 MR. CARLSON: I believe the question you
4 are asking will, in fact, be a focus of our technical
5 discussions moving forward.

6 MR. GUNTER: Is there a way to get -- I
7 don't know if it's appropriate to ask for a gut
8 reaction but I know from a public position this is --
9 it would seem to be an issue that is very startling
10 and I'm wondering if I could get a response from the
11 NRC.

12 MR. JOLICOEUR: Well, we obviously
13 acknowledge this is a novel approach but, as you have
14 already said, is something we are going to work on in
15 the preapplication review, look at the data that is
16 presented and we will be able to give you a value
17 judgment at that point. Certainly based on what we
18 have so far we wouldn't be able to render that
19 judgment.

20 MR. RUBIN: I'm not a metallurgist by
21 training but the NRC to approve an application of this
22 sort will need to have an understanding of the failure
23 mechanisms, data behind those failure mechanisms, or
24 degradation mechanisms and we'll have to establish
25 some value of potential failure.

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1 We will have to conclude from the data and
2 analysis that there is ample margins to failure or
3 unacceptable degradation and boundaries, vision
4 product boundaries to issue a design acceptance. On
5 top of that for defense-in-depth purposes, and this
6 was part of my questioning, was the whole subject of
7 assurance that we truly did understand the degradation
8 mechanisms and through in-service inspections, in-
9 service testing monitoring programs. We will need
10 both for defense-in-depth.

11 MR. GUNTER: Could I ask just one last
12 quick question? Who is going to pay for the license
13 approval certification submission at this point? It's
14 not the town of Galena, right?

15 MR. CARLSON: I'm not going to speak on
16 behalf of the town of Galena. That would be a
17 question for them.

18 MR. JOLICOEUR: Let me clarify the
19 question. Are you talking about the design
20 certification or the design approval that we are doing
21 now?

22 MR. GUNTER: Well, obviously going through
23 this process is going to run up a bill and I'm just
24 curious right now who is picking up the tab.

25 MR. JOLICOEUR: For the design approval

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1 Toshiba is. We bill applicants for preapplication
2 activities.

3 MR. GUNTER: Thank you.

4 MR. CARLSON: The applicant for siting
5 related things would pay the bill for that.

6 MR. JOLICOEUR: To the phones.

7 MR. CARLSON: Okay. The next question
8 from the telephone.

9 MR. BURKE: Richard Burke, ISO New
10 England. Don, are you there?

11 MR. CARLSON: Yes. Yes, please go ahead,
12 Richard.

13 MR. BURKE: I had a question. The
14 question was there were seven White Papers produced as
15 funded by the State of Alaska. Those White Papers, I
16 guess, the Mayor of Galena back on September 26 in
17 conjunction with this meeting asked that they be
18 introduced concurrently with Toshiba's presentation.
19 I personally have read those White Papers and have
20 found them very informative and answered some of the
21 questions that staff and others have asked today. I
22 was hoping to hear more about that.

23 I realize that the time now wouldn't
24 permit that but I'm wondering if they would be
25 presented at a future date would it be part of a

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1 public meeting and who would present it. Would it be
2 the town of Galena or whom? That's my question
3 because I'm not sure who to direct that at.

4 The only comment I would have is that I
5 kind of reviewed this and having been involved in
6 nuclear power since the '06s the design is quite
7 innovative and passive.

8 I've worked in light water reactors and
9 have operated a nuclear plant commercially in this
10 country for 20 years so I have some background in
11 found this design to be, again, quite innovative and
12 I would think that some of the things like reduce
13 napping and worksheet planning zones and other things
14 that are promised could, in fact, be done if people
15 think out of the box because it's not a old light
16 water reactor design.

17 MR. CARLSON: I think perhaps one way to
18 address your question would be to Toshiba and
19 Westinghouse in terms of whether they see a nexus
20 between those White Papers and what the business of
21 the day here is and that is design approval and the
22 issues they want to pursue during preapplication
23 review for design approval.

24 MR. WRIGHT: Well, I don't know but I
25 think it's something that we need to further discuss.

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1 I think this work was commissioned by the city of
2 Galena. Is that correct?

3 MR. BURKE: State of Alaska, I think.

4 MR. WRIGHT: Yeah, it was. Okay. I think
5 they are really the ones we need to talk to. Unlike
6 you I haven't had a chance to read these White Papers
7 yet so I don't know.

8 MR. BURKE: I mean, I found them quite
9 informative. I think anybody that does read them will
10 find there is a lot of information there. It would be
11 a shame not to present them somehow on the docket.

12 MR. JOLICOEUR: Okay.

13 MR. CARLSON: Okay. The next question
14 from the room. Edwin Lyman.

15 MR. LYMAN: Thanks. I have a couple of
16 comments based on some of the things we've heard
17 already today. One is one the issue of the HCDAs and
18 whether or not they should be considered in the
19 licensing process. We heard, and I just want to
20 clarify, that Toshiba has not analyzed the core
21 disassembly --

22 PARTICIPANT: Sir, could you identify
23 yourself?

24 MR. LYMAN: Sorry. Ed Lyman from the
25 Union of Concerned Scientists. Toshiba is not yet

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1 analyzed the core disassembly accident and I would
2 like to point you to a presentation that Mr. Ueda gave
3 in 2005 on core disassembly accident on the 4S. It
4 was a discussion of evaluating them.

5 At that point it was said that no CDA
6 evaluation had been done, but they also pointed out
7 that a licensing body may require a CDA evaluation for
8 the 4S as a quasi deterministic assumption. I would
9 argue that this licensing should require that.

10 I would also point to the PRISM
11 preapplication, the staff's view of this in the course
12 of PRISM where it said that regarding accommodation of
13 HCDAs there was not sufficient data at that time to
14 confidently predict the size of an HCDA in a metal-
15 fueled ALNR.

16 Therefore, the likelihood of an HCDA being
17 accommodated when the PRISM vessel may remain an open
18 issue at least until more analytical or test data
19 become available. We are not talking about PRISM here
20 but we are talking about a similarly hypothetical
21 reactor. My question is have these data gaps been
22 closed to the extent that you can continue to ignore
23 HCDA.

24 In particular we are going to need to know
25 whether or not the containment will be able to protect

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1 against the most energetic plausible HCDA. I think
2 it's a little ridiculous after several decades that
3 there is still argument over whether this accident
4 should be considered or not. We think it should.

5 On the issue of fuel data I think there is
6 some question whether EBR-II body of data is really
7 representative or sufficient for making judgments
8 about the performance of this fuel in a 30-year
9 environment. I would also like to point out from the
10 same presentation back in 2005 that Toshiba in their
11 presentation, and I'm just reading from the overheads
12 here, they said that the analytical code for fuel
13 degradation 4S must be verified by safety tests up to
14 failure with irradiated fuels.

15 This sounds to me like an additional test
16 program on irradiated fuel and was part of the
17 package, at least back in 2005. My question is it
18 doesn't seem to be now. My question is what have you
19 learned between 2005 and now that would allow you to
20 no longer require any additional testing to validate
21 your fuel performance codes.

22 My third point has to do with the
23 plutonium versus uranium fuel in the reactor. My
24 understanding is the reactor was originally designed
25 with plutonium fuel and now it has been redesigned

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1 with LEU and we think that's a good thing but my
2 question is what is the motivation for that and is
3 this decision already written in stone? Is this the
4 final fuel form that we would expect to see when you
5 come in for design approval here or is the potential
6 for going back to plutonium still there? Thank you.

7 MR. CARLSON: I believe those questions
8 were addressed toward the preapplicant if they would
9 like to say anything or take it upon themselves to get
10 back to us on that.

11 MR. EL-SHEIKH: Yes, the hypothetical core
12 disruption accident has been in the history of liquid
13 metal reactors. Let's remember there has been a lot
14 of development since this issue was faced and there
15 has been a substantial effort to design against it.

16 One of the things that is true with
17 nuclear reactors is that we have tried to learn from
18 the problems or potential problems and tried to design
19 against them. The negative feedbacks that are in that
20 reactor indicate that it is very remote that you would
21 have any CDA. That would be proven to the
22 satisfaction of the regulators that there will be no
23 core damage.

24 Nevertheless, because we will deal with a
25 defense-in-depth concept we might say, all right,

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1 though we have enough confidence that would not
2 happen, nevertheless we are going to do this just in
3 case something happens. This is the kind of argument
4 that was given in PRISM and that was given in other
5 reactors.

6 There has been a development in terms of
7 the design, in terms of that this is a unique design.
8 Please look at it as a unique design because one of
9 the objectives of it was not to have a duplicate.
10 Let's not carry on the history of the past. We learn
11 from things in the past and we try to improve the
12 safety. Now we add to that that we want to improve
13 the security of the nuclear reactor. Let's consider
14 that. I guess that is my comment.

15 MR. CARLSON: Now do we have any questions
16 from the public in the room?

17 MR. YODER: My name is Marvin Yoder. I am
18 the consultant now to the City of Galena. I was a
19 manager there for 10 years and was there when we
20 started this process. I believe you got a letter from
21 Alaska Electric Power indicating their support for us
22 to continue on with this project. I also have a
23 letter from the City of Nome which I will present to
24 the Commission as well.

25 It was four years ago when representatives

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1 from Toshiba first visited Galena and presented
2 information to the community regarding the 4S nuclear
3 battery. Based on that presentation the city council
4 decided to gather additional information about the
5 Toshiba 4S.

6 We initiated two studies, the first one
7 funded by DOE to compare the economic feasibility and
8 environmental impact of generating power from the
9 Toshiba 4S versus other generation alternatives. The
10 study concluded that the 4S was preferred alternative
11 based on lower cost of generated power and less impact
12 on the environment.

13 The second study was a series of White
14 Papers funded by the State of Alaska. The White
15 Papers were prepared by Burns & Roe and Pillsbury
16 Winthrop Shaw Pittman and dealt with various issues
17 relating to the deployment of the 4S reactor in
18 Galena. Galena would like an opportunity to discuss
19 these papers with the NRC staff at an opportune time.

20 In February of 2005 Galena met with staff
21 from the NRC to explain the difficulty that Galena and
22 other rural or frontier communities have in supplying
23 power to their residents. These communities are
24 remote, off the grid, must purchase all their fuel in
25 the summer, and are dependent on an ever escalating

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1 cost of diesel.

2 It is noteworthy that in 2005 we reported
3 bulk fuel cost of \$1.50 a gallon. Since then the cost
4 has increased by more than 100 percent. There are
5 communities near Galena that are now paying a dollar
6 a kilowatt for electricity. With oil prices now
7 hitting new records the hardships are going to be
8 amplified.

9 In the past four years there have been
10 many questions raised about the feasibility of
11 operating a nuclear plant in a remote location such as
12 Galena. Galena's interest generated opinions both pro
13 and con and a lot of speculation regarding the
14 advisability of placing a nuclear plant in our
15 community.

16 The city council has continued to favor
17 the consideration of the Toshiba 4S based on
18 information from several sources. Primarily we have
19 been impressed by the commitment of Toshiba and CRIEPI
20 to fund the research and development needed to make
21 this project viable.

22 Past experience in Idaho with EBR-II, the
23 current JOYO experimental reactor in Japan also give
24 us confidence. The President's GNEP initiative, which
25 contain elements regarding burner reactors and small

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1 reactors with emphasis on a reactor core that lasted
2 the life of the reactor.

3 Finally, United Nations nuclear advisor
4 Mohammed ElBaredei recommended the installation of
5 hundreds of small reactors around the world each of
6 which would serve a single village and using reactors
7 with long core life. Taken together these convinced
8 us that this was something viable that we need to
9 continue to look at.

10 My view is that the design certification
11 process or the approval that we are talking about at
12 the meeting today will lead to a decision point for
13 Galena's consideration of this technology. Once the
14 requirements and conditions of the nuclear design and
15 the site permitting the licensing of the 4S are known,
16 Galena will have the information needed to evaluate
17 the feasibility and the practicality of using this
18 technology in Galena.

19 Neither the financial feasibility nor the
20 environmental impacts of such a reactor can be fully
21 known until the NRC has proceeded with its review.
22 Knowing the past record of thoroughness by the NRC we
23 are confident that when a favorable design
24 certification is made the Galena community can
25 reasonably be assured that the safety of our people

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1 and our environment will be protected.

2 Thank you again for this opportunity and
3 we will send a formal letter requesting a chance to
4 present the White Papers. Thank you.

5 MR. CARLSON: Okay. Now is the time for
6 anybody on the phone to provide a question or comment.

7 MR. BODONY: This is Tim Bodony from KIYU
8 radio in Galena.

9 MR. CARLSON: Can you speak a little more
10 directly into the phone? You are very faint here.

11 MR. BODONY: Okay. How is that?

12 MR. CARLSON: Bodony from the radio
13 station in Galena.

14 MR. BODONY: Yes. Is anyone from Toshiba
15 or Westinghouse willing to state how much money has
16 already been spent on R&D for the 4S project and how
17 much more will be needed to bring it to fruition.

18 MR. CARLSON: Did you understand the
19 question?

20 MR. SAKASHITA: Toshiba has already spent
21 huge money such as several million or something.

22 MR. CARLSON: What was the number you
23 gave?

24 MR. SAKASHITA: Several million. Tens of
25 millions.

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1 MR. CARLSON: Okay. I think we had two
2 questions in the room in a row so I'll do the same
3 favor for those on the phone. Any other questions
4 from the phone? I'll take that as a no and so anymore
5 questions here in the room?

6 MR. JOHNSON: Hi. My name is Louis Tom
7 Johnson. I'm here from the city of Galena. I felt it
8 was important to say a few words today being the one
9 elected official from the city of Galena here. I am
10 here to stay involved and informed with the process
11 that Toshiba and CRIEPI are embarking on.

12 I've lived in Galena for nearly 35 years
13 and have raised my family there. My wife's
14 grandfather, Edgar Nollner, was one of the original
15 settlers to Galena and was the last surviving musher
16 that took part in the infamous None Serum Run.

17 I think I understand the native elders'
18 desires to see the small rural communities continue to
19 be able to live the traditional lifestyles they grew
20 up with. Many of our elders today are trying to make
21 ends meet on a Social Security check. A few get a
22 longevity bonus from the State of Alaska of a couple
23 hundred dollars and an annual dividend check.

24 I'm here to tell you that with electricity
25 in Galena at 40 cents a kilowatt and up to as high as

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1 one dollar a kilowatt in the surrounding communities,
2 heating fuel at \$4 a gallon, gas at \$5.25 a gallon, it
3 is impossible for many elders to stay in the
4 communities they grew up in.

5 It may be unfortunate but the current
6 generation of working adults is unable to live for
7 that lifestyle and effectively raise and support a
8 family. To raise their families in the community they
9 grew up in they often have to seek jobs in oil fields
10 or gold mines working two weeks on and two weeks off
11 to earn enough to survive with the high cost of
12 utilities in the rural areas.

13 Many find it just simpler to leave their
14 communities and move to the urban elders which our
15 elders do not want to see their children forced to do.
16 There are many challenges facing the rural areas of
17 the world with clean water, sanitary sewer conditions,
18 proper trash collection, education of our children,
19 and availability of reasonably priced groceries.

20 All of these things require a certain
21 amount of hydrocarbon resources to provide, not to
22 mention the heating of our homes and the driving of
23 our vehicles which in our case includes boats,
24 airplanes, snow machines, and 4-wheelers as there are
25 no roads to Galena. It becomes clear that the single

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1 biggest item that impacts the lifestyle in the rural
2 areas of the world is the cost of energy to support
3 the required infrastructure.

4 Our options were evaluated by a DOE study
5 and it was determined that nuclear power from a 4S
6 style of reactor would provide a cheaper long-term
7 source of energy. The city council of Galena has
8 always said that they were interested in a potential
9 source of predictable long-term reasonable energy.

10 We have also said until the design has
11 been evaluated and reviewed and hopefully eventually
12 approved by the NRC, it was too early to dismiss the
13 idea based on assumptions and innuendos about
14 potential environmental impact concerns. We always
15 anticipated some groups would prematurely oppose any
16 nuclear project before the specifics of the design
17 could be fully evaluated and I guess that is just the
18 nature of the nuclear world.

19 We are hopeful that with the heightened
20 global concern with global warming and greenhouse
21 gases that some of the groups that may have
22 traditionally been anti-nuclear may realize that
23 nuclear could be the best and maybe the only realistic
24 hope to stem the ever-increasing amount of greenhouse
25 gas emissions in our ever-growing rural society.

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1 In summary, I would say that I believe
2 that everything we have seen concerning the 4S project
3 leads us to believe that it has a place in the world
4 as one piece of the solution to the ever-rising cost
5 of hydrocarbon fuels and the ever-increasing amount of
6 greenhouse gases being released into our environment.

7 Galena continues to hope that the 4S may
8 be a solution to these problems in our region of the
9 world with NRC's eventual review and approval of this
10 new small, simple, safe, and secure innovative design.
11 Thank you.

12 MR. CARLSON: Are there anymore comments
13 from the phone line? Okay. We'll go on to the next
14 comment from the room.

15 Ed.

16 MR. LYMAN: I just think that the last
17 question I had asked might have gotten lost and I'm
18 really hoping to get an answer with regard to the
19 final decision on the fuel composition. Can we take
20 it for granted that the fuel is going to be LEU and
21 not plutonium based?

22 MR. SAKASHITA: Yes, that's not plutonium.

23 MR. LYMAN: Is there another version of
24 the 4S you may be interested in marketing elsewhere
25 that would have plutonium as the fuel?

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1 MR. SAKASHITA: At this moment the 4S is
2 actually faster reactor but there is no commercial
3 base to use plutonium so we have no plan to use
4 plutonium.

5 MR. LYMAN: All right. Thanks.

6 MR. CARLSON: I think there were more
7 questions in the room. Any questions or comments from
8 the room? Any questions or comments from the phone
9 line? Okay. Well, I think we finished on schedule,
10 10 minutes ahead actually. Thank you all for your
11 participation and your interest. The meeting is
12 adjourned.

13 (Whereupon, at 4:51 p.m. the meeting was
14 adjourned.)

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