

NUCLEAR REGULATORY COMMISSION

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502nd Meeting

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

502nd MEETING

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FRIDAY

MAY 9, 2003

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The meeting was held in Room T2B4, Two
White Fling North, Rockville, Maryland, at 8:30 a.m.,
Mario V. Bonaca, Chairman, presiding.

PRESENT:

MARIO V. BONACA, ACRS Chairman

GRAHAM B. WALLIS, ACRS Vice Chairman

GEORGE E. APOSTOLAKIS, ACRS Member

F. PETER FORD, ACRS Member

GRAHAM M. LEITCH, ACRS Member

DANA A. POWERS, ACRS Member

VICTOR H. RANSOM, ACRS Member-at-Large

THOMAS S. KRESS, ACRS

WILLIAM J. SHACK, ACRS

JOHN S. SIEBER, ACRS

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1 STAFF PRESENT:

2 JOHN LARKINS, Executive Director

3 SAM DURAISWAMI, ACRS/ACNW

4 SHER BAHADUR, ACRS/ACNW

5 HOWARD J. LARSON, Special Assistant,
6 ACRS/ACNW

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C O N T E N T SPAGE

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P R O C E E D I N G S

(8:33 a.m.)

CHAIRMAN BONACA: Good morning. The meeting will now come to order.

This is the second day of the 502nd meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the committee will consider the following:

Subcommittee report on the revised application for the mixed oxide fuel fabrication facility;

Subcommittee report on the integrated industry initiating event of former syndicator;

Future ACRS activities;

Report of the Planning and Procedures Subcommittee;

Reconciliation of ACRS comments and recommendations;

And proposed ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswami is the designated federal official for the initial portion of the meeting.

We have received no written comments or

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1 requests for time to make oral statements from members
2 of the public regarding today's sessions.

3 A transcript of portions of the meeting is
4 being kept, and it is requested that speakers use one
5 of the microphones, identify themselves, and speak
6 with sufficient clarity and volume so that they can be
7 readily heard.

8 Before we proceed, I would like to
9 announce that Barbara Whitaker, who has been with us
10 for the past three years, is leaving the ACRS to join
11 RES on June 1st, 2003.

12 Where is Barbara?

13 PARTICIPANTS: She's not here.

14 CHAIRMAN BONACA: She's not here.

15 Well, we would like certainly to thank her
16 for her outstanding administrative support to the ACRS
17 and wish her good luck, and we hope you have an
18 opportunity to go by her desk and let her know because
19 she's not here right now.

20 MEMBER POWERS: Slaving away for us right
21 now.

22 CHAIRMAN BONACA: Slaving away for us.

23 With that I'll move to Dana who is going
24 to give us a summary report on the revised application
25 for the mixed oxide fuel fabrication facility.

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1 MEMBER POWERS: I didn't know we were
2 going to be on the record for this. We're not quite
3 prepared for that, but we can do that because we've
4 got all kinds of support crew here to see how well I
5 learned the lessons from all of these subcommittee
6 meetings we've had.

7 What I wanted to try to accomplish today
8 was to brief the committee a little bit on where we
9 stand on this particular review of the MOX facility,
10 MOX fuel fabrication facility, and remind you that
11 this is one of those activities the Commission has
12 specifically asked us to take a look at and address
13 for them, and it's a little bit different world than
14 what we're used to working in. This is definitely not
15 a power reactor.

16 A different set of regulations apply to
17 it. There's a different set of terminologies that
18 apply to it, altogether a different world, and what
19 I'll try to do is give you a brief synopsis of this
20 world, try to direct you to the right parts of the
21 Code of Federal Regulations for looking at things, and
22 give you a status on how we're going to proceed with
23 this.

24 You'll recall we're on a pretty good pace
25 to get everything done about a year, two years ago

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1 almost, and then there was some change in the mission
2 that, quite frankly, was probably horribly time
3 consuming for the folks at DCS to make the changes,
4 but it wasn't a very big perturbation in the facility
5 from a safety perspective. So a lot of our past work
6 stands in good stead for that.

7 So right now I see us moving on at a
8 pretty expeditious clip on the whole thing.

9 Well, this says the mixed oxide fuel
10 fabrication facility. I think everybody understands
11 this is a facility for manufacturing mixed oxide fuel
12 for use in commercial nuclear reactors using weapons
13 grade plutonium. There is a health amount of
14 information in the world's literature on the use of
15 mixed oxide fuels in commercial nuclear power plants.

16 That experience, however, is largely with
17 what you would call reactor grade plutonium, and this
18 is going to use weapons grade plutonium. How big the
19 perturbation is is a lot in the eyes of the beholder,
20 but it's clear that it's a perturbation.

21 That part of this activity, using the fuel
22 in the reactor, is not part of this review. We're
23 only looking at the fabrication of the fuel itself.

24 MEMBER KRESS: Where does Mileadadum
25 trifluoride enter the picture?

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1 MEMBER POWERS: Well, I have no idea why
2 you ask the question, Dr. Kress, because there is no
3 Mileadadum indicated up there. The Mileadadum symbol
4 is MO. M is well known to stand for mixed oxide.

5 MEMBER KRESS: Oh. My mistake.

6 (Laughter.)

7 MEMBER POWERS: The facility that they're
8 setting up has additional peculiarity that they're not
9 going to be terribly used to, is that it is located on
10 the Savannah River site, which is a DOE facility, and
11 it is a huge reservation.

12 There it is. Here's the site boundaries
13 out here. And I forget. It must be about five miles,
14 six miles between the facility and the site boundary,
15 and even when you get to the site boundary, you've got
16 a long ways to go before you hit civilization. Some
17 people say several states.

18 (Laughter.)

19 MEMBER RANSOM: Dana, where are the old
20 production reactors?

21 MEMBER POWERS: The Savannah River site.

22 (Laughter.)

23 MEMBER RANSOM: But you don't know where?

24 MEMBER SIEBER: From north to south it's
25 40 miles.

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1 MEMBER POWERS: It's a fair sized
2 facility. There's a lot of agonizing over the fact
3 that there's a public road that goes through there.
4 That's something that Savannah River has put up with
5 for years. They've got decent ways to deal with that
6 particular problem.

7 Locating things on the Savannah River site
8 really gives you some interesting benefits. You've
9 got a well developed structure for security certainly,
10 a well developed structure for things like external
11 fire department responding to an event at the
12 facility.

13 We'll discuss the problem of the
14 collocated workers, which figures a lot in the debates
15 on this subject. I think it's a tempest in the teapot
16 because what you've got is a bunch of people on this
17 site unassociated with the facility, but they're
18 reasonably disciplined folks that are under reasonable
19 control. I mean, they're a lot easier to control than
20 a generalized public.

21 The facility also has this peculiarity
22 that it's receiving a product from a DOE operation,
23 regulated, patrolled, safety assessed by DOE. It goes
24 into the mixed oxide fuel fabrication facility. The
25 effluents from that facility go back into the DOE

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1 system and outside of NRC control. The product goes
2 off to commercial reactors, presumably Catawba and
3 McGuire, and, no, Dr. Kress, I do not know why ice
4 condensers are peculiarly appropriate for mixed oxide
5 fuel, but that's not part of this review.

6 MEMBER KRESS: Okay.

7 MEMBER POWERS: And presumably the
8 irradiated product then comes back into the DOE
9 system. So this is going to be an island of NRC
10 regulation within the DOE site. It will be
11 interesting to interview the people developing this
12 facility after a few years of operation to see whether
13 they prefer DOE oversight or NRC oversight.

14 I will definitely place my bets on how
15 that outcome is.

16 We have developed in this country a lot of
17 facilities for handling plutonium based fuels in this
18 country. We haven't done any in the last 25 years,
19 but the technology is reasonably established, and what
20 they are doing at this facility is that they are
21 borrowing, adapting, learning from more modern
22 facilities that have been set up in France.

23 It's not a copy of a facility in France,
24 but you know, it has benefitted from their more recent
25 experience, but it's using relatively established

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1 technologies.

2 These are leaning forward in the trenches
3 in modernization of this, and the major elements, you
4 dissolve plutonium dioxide. You run a PUREX process.
5 Then you cinder up some powders, disburse that and
6 it's into UO_2 powders, make some fuel pellets, and put
7 it in fuel rods.

8 There is nothing in this that would not be
9 familiar to people that have been handling plutonium
10 in the past.

11 VICE CHAIRMAN WALLIS: This is like the
12 facility that we visited in France.

13 MEMBER POWERS: Very much like this, very,
14 very much like that.

15 For those of you who are not familiar with
16 the PUREX process, this is a solvent extraction type
17 of process where you're moving plutonium and uranium
18 from an aqueous phase into an organic phase, variously
19 known by names like -- what is it? -- normal
20 paraffinic hydrocarbon, but to anybody else is known
21 as kerosene.

22 A little more detail on the process here.
23 It just shows you that they like to divide it down
24 into what they call the AP and MP processes. AP
25 stands for aqueous polishing. MP, I can never

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1 remember what it stands for, but that results in your
2 making fuel rods.

3 I think there's nothing terribly
4 surprising about what the facility looks like. What?
5 I think it's a three story building laid out with the
6 various areas defined. It operates with a relatively
7 conventional, multiple nested zone kind of
8 heating/ventilation system so that the leakage is all
9 inwards, fairly familiar technology.

10 Because it's located in a site, you need
11 to stay aware of what boundaries are, and you have a
12 site boundary that's way the heck out, and these are
13 the definitions for the boundaries that come out of
14 Part 20.

15 That boundary is really controlled by the
16 Savannah River site itself. Then you have controlled
17 areas and restricted areas. What these help you do is
18 define facility workers, what I like to call
19 collocated workers. I think they use a different term
20 for it, but it means the same thing, and the public.
21 The public is outside the site boundary.

22 The facility workers are the guys
23 obviously within the restricted area. In between you
24 have lots of people who are working on the Savannah
25 River site, and even people associated with the

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1 facility that don't ordinarily constitute radiation
2 workers.

3 Okay. That ha in the past always been a
4 subject of a large amount of debate. Why don't you
5 treat people on the site, but not associated with the
6 facility as the public? It's extraordinarily
7 different to understand why the secretary working in
8 the SRS building is any different than the secretary
9 working in a bank outside the site as far as her
10 volunteering for radiation exposure.

11 Well, that debate has gone on, gee, as
12 long as I can remember, and I think they've come up
13 with a reasonable compromise on this sort of thing.
14 They say, "Well, we'll just educate these people, and
15 they'll know what to do in the event of an emergency.
16 They'll be aware of what the facility context, and
17 they'll know what to do in case there's an accident.
18 And so we will treat them a little bit differently
19 than the public and clearly not call them facility
20 workers."

21 Okay. Well, things are different when you
22 work with facilities. You're working with a different
23 set of regulations. I'm going to focus just on the
24 criteria that come out of 70.61. Here are the dose
25 limits that you have. For workers we're trying to

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1 keep doses below 25 REM. The public, you want to keep
2 them below five REM.

3 MEMBER KRESS: I don't see a third
4 criteria for that group you just talked about.

5 MEMBER POWERS: Well, they become --

6 MEMBER KRESS: Workers?

7 MEMBER POWERS: -- workers because they're
8 educated, right.

9 MEMBER KRESS: Okay They're included.

10 MEMBER POWERS: Well, they're different
11 things, and I don't want to go into all of the
12 subtleties on that.

13 I think the more limiting issue here is
14 really this criterion of 24 averaged releases off the
15 site of 5,000 times Table 2. Those of you that get to
16 work with Table 2, I don't need to explain to you what
17 it is.

18 Those of you that have never had the
19 pleasure of dealing with Table 2 and Appendix B of
20 Part 20 really ought to do it.

21 MEMBER APOSTOLAKIS: I thought we were
22 fortunate.

23 MEMBER POWERS: It's an experience that
24 will enlighten and educate you.

25 MEMBER APOSTOLAKIS: Okay.

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1 MEMBER POWERS: At this stage in the
2 process for the MOX facility, we're dealing with the
3 design basis. They're seeking a permit to go
4 construct this facility, and the regulations specify
5 what you're supposed to do, and you're supposed to
6 address all of these topics that I have listed down
7 here.

8 I'm anxious for the committee to delve
9 deeply into the first one and explore all of its
10 nuances and ramifications in great depth. The
11 subcommittee itself doesn't intend to.

12 More interesting than that list of --

13 MEMBER APOSTOLAKIS: Dana, wasn't The PRA
14 there on the list? I didn't -- or an ISA. Is that
15 what they're doing?

16 (Laughter.)

17 MEMBER POWERS: GRA, George.

18 MEMBER APOSTOLAKIS: ISA.

19 MEMBER POWERS: No. You will learn to say
20 ISA with a smile on your face.

21 MEMBER APOSTOLAKIS: There will be a
22 letter form this committee that we use the word "ISA,"
23 the acronym?

24 MEMBER POWERS: Not for this stage.

25 MEMBER APOSTOLAKIS: Okay.

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1 MEMBER POWERS: ISA --

2 MEMBER APOSTOLAKIS: So we have time to
3 educate themselves.

4 MEMBER POWERS: ISA is going to be used to
5 identify the items relied on for safety, IROFs.

6 MEMBER APOSTOLAKIS: Isn't that some that
7 that Mary Drewin (phonetic) and her project on
8 coherence should pick? It is just trying to harmonize
9 the regulations. Why are we using ISA here and PRA
10 there?

11 MEMBER SIEBER: Yeah, we should drop PRA.

12 MEMBER APOSTOLAKIS: I'll talk to Mary.

13 MEMBER POWERS: Why don't you be nice and
14 let Mary at least sort out her problems with reactors?
15 Once she's proven herself on that, we will let her
16 move into facilities.

17 MEMBER APOSTOLAKIS: It may be late.

18 MEMBER POWERS: The number of mixed oxide

19 --

20 MEMBER APOSTOLAKIS: You're using defense
21 in depth, too?

22 MEMBER POWERS: Once mixed -- remember
23 mixed oxide fuel fabrication facilities we intend to
24 review in this country is fairly limited right now,
25 George.

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1 MEMBER APOSTOLAKIS: Yeah.

2 MEMBER POWERS: So I would not expend an
3 enormous amount of effort plaguing poor Mary and her
4 activities.

5 MEMBER APOSTOLAKIS: It's initial national
6 importance.

7 MEMBER POWERS: More interesting to me
8 than the debate over ISAs or PRAs or some of the other
9 standards that they're using, and they use defense in
10 depth, but they have a peculiar definition of defense
11 in depth, and I list it up here in hopes that no
12 members slit their veins over this definition of
13 defense in depth because this is actually in the
14 regulations, and we can't change it. This easily is
15 one of the worst definitions of defense in depth
16 I've --

17 MEMBER KRESS: That was in the white
18 paper.

19 MEMBER POWERS: What did you say?

20 MEMBER KRESS: That was in the white
21 paper.

22 MEMBER APOSTOLAKIS: Not this. Was this?

23 MEMBER KRESS: Yeah.

24 CHAIRMAN BONACA: The second paragraph,
25 yeah.

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1 MEMBER POWERS: This one just doesn't cut
2 it if you ask me in the definition of defense in
3 depth, but it will do for this facility.

4 The other requirements are that the design
5 must incorporate to the extent practical preferences
6 for engineered controls and enhance safety.

7 The strategy the application is adopting
8 is consistent with this approach. He has a mitigation
9 of prevention and mitigation in his facility. He is
10 looking at a large amount of redundancy in things like
11 the power coming into the site. They have this
12 conventional nested ventilation system for preventing
13 leaks to the outside, and they use a HEPA filtration
14 system.

15 That cause pause to us because in the
16 traditions of the Savannah River site where it has
17 always been to use sand filters for these, there has
18 been a bad history within the DOE complex in using
19 HEPA filtration systems, and we pursued this in great
20 depth, and I can definitely attest that the people
21 working for the applicant on HEPA filters know more
22 about HEPA filters than I will know if I stay up
23 nights studying, and they have definitely optimized
24 that technology and are using it in a redundancy
25 that's pretty interesting.

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1 It's redundancy, but not so much diversity
2 that makes for interesting discussions on defense in
3 depth, but looks to be effective.

4 Well, the application of the SER cover a
5 huge number of topics, a variety of safety
6 considerations. Where have we been focusing our
7 attention?

8 We've focused really in the areas of fire
9 and criticality. When you think about this facility
10 and getting radiation off the site boundary,
11 radioactive material off the site boundary affecting
12 the public, the only ways you think you can do it is
13 fire. There is just not another mechanism for doing
14 it.

15 If you think about how you contaminate the
16 site with things other than plutonium, the only way
17 you can do it is a criticality event. And so these
18 are the things that have occupied our attention.

19 The area of criticality is fairly well
20 established technology for preventing a criticality.
21 There's a double contingency standard. This is an
22 area of some ongoing discussion between the staff and
23 the applicant on the implementation and devotion that
24 you will give to the double contingency principles.
25 But, quite frankly, those principles have served us

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1 well in these areas.

2 We have a couple of questions as we go
3 into this on other areas of potential criticality.
4 Much of our attention has been devoted to fire, and
5 fire is an issue for this facility. One of the
6 working fluids you have is kerosene, and there's a lot
7 of it on this site.

8 A lot of it is contained in welded steel
9 piping systems, and it's a little hard to understand
10 how you would ignite it, but quite frankly, you're
11 working with kerosene, and so there's a potential for
12 fire.

13 The other areas of fire is this peculiar
14 thing called red oil, and if you have not worked in
15 solvent extraction systems for plutonium, you turn
16 around and start making funny jokes about communist
17 petroleum products creeping into our system.

18 Red oil is one of those little mysteries
19 of process chemistry that abound in all big process
20 chemistry operations. This one involves a
21 decomposition product or the extractive agent, which
22 is tertiary butyl phosphate that decomposes and
23 combines in some way with metal ions in nitrate to
24 form something that can burn and burn fairly
25 energetically.

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1 It has been encountered in the PUREX and
2 its predecessor processes now for, gee, I guess the
3 first one was back in the --

4 MEMBER SIEBER: Forty years.

5 MEMBER POWERS: -- 1940s was the first
6 time it was encountered.

7 MEMBER SIEBER: Forty or 50 years.

8 MEMBER POWERS: Fifty years or something
9 like that, and there have been some spectacular
10 events.

11 Every time there's one of these events,
12 people launch a big effort to understand what red oil
13 is. It's complicated. It's difficult to reproduce in
14 the laboratory.

15 They usually despair and apply some
16 administrative controls to avoid the problem, and we
17 go for another several years until some new feature of
18 the red oil fabrication bites us.

19 MEMBER SIEBER: I guess it's hydroxyl
20 amine nitrate, which is temperature sensitive.

21 MEMBER POWERS: That's another one we'll
22 get to.

23 MEMBER SIEBER: Okay.

24 MEMBER POWERS: This red oil is weird.

25 What happened within the community working

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1 with the PUREX process is they have found empirically
2 that if they keep the temperatures low and do not
3 allow the accumulation of degradation products for
4 long times in the system, that they avoid the red oil
5 process.

6 And that works. We don't have red oil
7 problems when you do that sort of thing.

8 The applicant himself is exploring the
9 chemistry in more detail. It's very interesting, but
10 quite frankly, he's adopting the empirical guidelines
11 that have been developed over the years. They just
12 keep the temperature low and don't allow the
13 accumulation of degradation products as you recycle
14 this solvent and the extraction agent through the
15 system. In other words, we replace it every once in
16 a while.

17 There's another ammonium nitrate problem
18 in the system similar to the kinds of empirical things
19 to handle those problems. We have asked them about
20 ammonium nitrate accumulation in ducts and things like
21 that. I presume they'll get back to us.

22 My experience is that we have on occasion
23 seen ammonium nitrate accumulation in duct work, but
24 never any amount that would amount to anything. I
25 mean, it's dust here and there.

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1 There are also interesting fire hazards
2 associated just with working with the zirconium
3 cladding on fuel. Zirconium metal has a history of
4 spontaneous combustion when it's mistreated or
5 inappropriately stored.

6 More interesting, I think, is an issue
7 raised by the brethren on the ACMW when they attended
8 the meeting, was to focus some attention on the
9 hazards associated with the waste streams and their
10 waste handling areas and whether there were fire
11 hazards associated with that.

12 Well, this is some of the issues that have
13 arisen in the course of the subcommittee meeting.
14 There is a catechism that has been developed primarily
15 in the Department of Energy for evaluating the hazards
16 posed by accidents at their plutonium facilities. The
17 last time I spoke to you, I think I went into some of
18 the details of what's called the five factor formula,
19 which involves taking the product of the material
20 that's at risk, the damage ratio, and the damage that
21 occurs to the facility. What's the airborne release
22 fraction from that? How much of that is respirable?
23 What fraction of that leaks?

24 The catechism that's developed is that you
25 go through this process, and you get to this airborne

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1 release fraction. You go to a database. A lot of us
2 call the Mishima database because Joe Fu Mishima put
3 it together from year and years of experimentation he
4 had done on what kinds of fractional releases you get
5 when you abuse and torment plutonium in various forms.

6 He put them all together in a book. If
7 you look up and you find an experiment that you think
8 is appropriate, you take the airborne release fraction
9 out of that. You assign some respirable fraction to
10 it, and you proceed with the multiplication.

11 There are at least two difficulties that
12 you encounter in applying the Mishima database. First
13 of all, which of all these things do you pick?

14 There are a lot of experiments that you
15 can pick, and it is never obvious to me at least which
16 one is the appropriate one to use.

17 The next issue you have is Joe Fu did his
18 experiments like he put a piece of paper in a Bunsen
19 burner and looked at what fraction of the plutonium on
20 that filter paper went up the stack.

21 Joe Fu did not do experiments in which he
22 took mixed oxide fuel fabrication facilities and
23 initiated accidents and measured the release fraction.
24 How do you take the release fractions that Joe Fu got
25 in his experiments and say what's the release fraction

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1 that you get from an accident at the facility?

2 The contention is made that these release
3 fractions are bounding, from the database are bounding
4 on the release fractions that you would get from the
5 events at the facility.

6 I have no doubt that that's true. It is
7 certainly true that in most cases the respirable
8 fraction is taken as one, and I will concede that
9 adopting the respirable fraction as bounding, I have
10 no problems with that.

11 The release fractions being bounded, I'm
12 quite sure they're true. However, my experience has
13 been that in the fuels area that we usually take
14 experiments and apply an elaborate amount of physics
15 to go from the experiment that we do on a small piece
16 of fuel to predicting what happens in reactor
17 accidents.

18 That phenomenological scaling, if you
19 will, is at least not transparent to me from the
20 database, what's done in the safety analysis, and
21 consequently, I don't understand why one can have a
22 confidence that the assessments they've done are
23 bounding.

24 What I do have a confidence in is that
25 this facility does not pose an enormous amount of

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1 hazard and that you can probably adjust those release
2 fractions by orders of magnitude and still not pose a
3 hazard, and it's a little bit much to make a big deal
4 about this, but I would say that this is one of the
5 areas that the subcommittee is still pursuing.

6 More important to me is the issue of fire
7 protection at the facility, though, in fact, I think
8 they have a pretty good fire protection program
9 planned for the MOX facility.

10 What I don't see is a very clear, precise
11 design basis for the fire protection system. I would
12 like to see something akin to what we do for the
13 reactors that say we will have a channel, a pathway
14 for shutting this facility down, and understand
15 shutting down the facility is a peculiar comment. You
16 don't really want to shut it down. You want the
17 ventilation system to keep working.

18 PARTICIPANT: To keep going.

19 MEMBER POWERS: So keeping this facility
20 working in the event of a fire, and I think they can
21 do that. It's just not a clearly set.

22 There are some problems, some issues that
23 have risen with respect to the strategies for
24 suppressing fires. In one area they are using what
25 they call a clean agent for suppressing fires, and

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1 what a clean agent is is some mixture of basically
2 carbon dioxide that blankets the burning material and
3 denies it oxygen. So the flames disappear.

4 But it does not quench the hot material.
5 In fact, it helps insulate the hot material, which is
6 already insulated by a char. Consequently, when the
7 clean agent is disbursed and oxygen again has access
8 to the material, the flames burst up again.

9 Those of you that recall our discussion of
10 the fire in the cabinets, in the instrumentation
11 cabinets at San Onofre, saw that that happened several
12 times, that they would suppress the fire with the CUS-
13 2 extinguisher. They'd open up the cabinet, take a
14 look at what kind of damage that had been done, and it
15 would promptly burst into flames.

16 It can be even worse than that. While
17 this stuff is hot, but not burning, it bakes out all
18 of the nice, volatile organics, which accumulate
19 because they're heavier than air. The oxygen comes
20 in, and you get a vapor combustion event that can be
21 modestly surprising.

22 Again, with the criticality in the waste
23 handling zone, it's something we're continuing to look
24 at, and you'll never guess that at least one member of
25 the committee raised the issue of material selection

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1 and corrosion. I'll leave it to you to guess who
2 might have raised that question.

3 It is a non-trivial question. Some of the
4 feeds they will be using do have chloride
5 contamination, a stainless steel system. It would be
6 an unfortunate thing to have a piping mistake in that.

7 Yes, sir?

8 MEMBER RANSOM: I wonder if they
9 considered the danger of the CO₂ extinguishing system.
10 You know, out at ATR they killed a couple of people
11 because of accidental discharge of the --

12 MEMBER POWERS: Yeah, we had Link
13 Technologies, Ali and his team looked exactly into
14 that event. That's not really a hazard here. They're
15 using these things and nozzles and the glove boxes,
16 whatnot. We don't really have that problem here.

17 Well, the status. We have the best part
18 of a draft SER. Quite frankly, it is one of the
19 better SERs I've read recently. The staff in
20 producing this SER has in many cases, not all cases,
21 but in many cases, tried to communicate what the basis
22 they used in evaluating what the applicant has said
23 and why they think that that's a reasonable thing for
24 them.

25 The SER is quite comprehensive, as is the

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1 application report. They are basically pretty well
2 done documents.

3 There are a few outstanding issues. I've
4 listed down here 19. I'm sure that's a time dependent
5 quantity. Some of them are just adjusting language to
6 get that so that it's more aligned with what's in the
7 regulations. Some of them are a little more
8 substantive than that.

9 My feeling is that we're progressing
10 forward on this facility sufficiently that we can come
11 directly to the ACRS with this facility without having
12 another subcommittee meeting, barring some contra
13 temps in the resolution of the outstanding issues.

14 The burden in doing that, of course, is
15 that the members do need to reacquaint themselves with
16 the facility. You don't use it very often, and you
17 just need to familiarize yourself with what they're
18 trying to accomplish here in the safety analysis for
19 this phase.

20 There is a second phase in the licensing
21 process, which is the possession and operation permit.
22 Right now we're just setting down the design bases for
23 the construction permit, but it looks to me like we
24 can come directly to the committee. I think everybody
25 has got their stories pretty well organized.

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1 I look at the schedule, and it looks to me
2 like there's an August deadline for the staff to
3 produce the report. That would mean they have to come
4 to us in July. Okay?

5 They haven't told me that's what they're
6 going to do. That's my guess of what they'll do. If
7 Drew objects, do object now. Otherwise I think we're
8 on a pathway to look at this facility in July.

9 You can look at the documentation on the
10 Web, and it's pretty easy to get to. It comes down
11 pretty quickly, and it's more convenient to look at it
12 on the Web than to get what amounts to a set of
13 documents about this big.

14 Some of the background materials that you
15 might want to look at, standard review plans and
16 things like that, you'd probably need to have supplied
17 to you. They're not so convenient to get to.

18 That's all I had to say about the
19 facility. We are benefitted by having representatives
20 both from the staff and the applicant here, who I
21 invite to give me a grade on my summary of the
22 facility and correct any errors that I might have
23 allowed to creep into my discussion of this facility.

24 MEMBER LEITCH: Dana, one question I had
25 when we talked about this 18 months or so ago related

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1 to operator selection staffing levels, training
2 levels. I assume that's still yet future.

3 MEMBER POWERS: That would be in the next
4 stage.

5 MEMBER LEITCH: Yeah.

6 MEMBER POWERS: That would be in the next
7 stage.

8 Now, they address it, but I consider that
9 to be more for information than it is in the specific
10 requirements in the regulations for this stage. They
11 do address training and a lot of activities like
12 inspections, that sort of thing. They actually go
13 into either a nice amount of detail or a mind numbing
14 detail, depending on your interest in the particular
15 subject, particularly in the application.

16 So, Peter, give me a grade. Tell me if
17 there's anything we need to add to this.

18 MEMBER RANSOM: Dana, I've got a question.
19 This is a commercial facility located on a DOE site,
20 I assume, right?

21 MEMBER POWERS: Well, roughly.

22 MEMBER RANSOM: What's to prevent a
23 nuclear power facility being located on a DOE site and
24 then you avoid all of the NRC troubles?

25 MEMBER POWERS: Did you have some

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1 perception that I was a lawyer?

2 (Laughter.)

3 MEMBER POWERS: Have I misled you in my
4 discussion?

5 MEMBER RANSOM: Well, it's the first time
6 I've ever heard of a commercial facility being located
7 on a DOE site.

8 MEMBER POWERS: well, in your old
9 homestead up in Idaho, they are planning to locate the
10 2010 reactor up there.

11 MEMBER RANSOM: NHTGR?

12 MEMBER POWERS: And so I guess there is no
13 prohibition against that.

14 MEMBER SIEBER: What about Hanford?

15 MEMBER POWERS: Well, Hanford, now,
16 Hanford supplied steam to a commercial facility off
17 site. I don't know exactly what an assigned boundary
18 is, but I think they're off the site.

19 MEMBER SIEBER: Well, N reactor was on
20 site.

21 MEMBER POWERS: N reactor was on site, but
22 they pumped their steam across the river to the
23 facility that generated the power.

24 MEMBER SIEBER: Across the river

25 MEMBER POWERS: Yeah.

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1 MEMBER KRESS: On a scale of one to ten,
2 I give you a grade of 11 and a half.

3 MEMBER POWERS: No, no. Thank you, Dr.
4 Kress, and I will pay you afterwards. I want to hear
5 from people that know something about this facility.

6 CHAIRMAN BONACA: All right. Well, thank
7 you for the informed presentation.

8 MEMBER POWERS: If Peter or Drew have
9 anything to correct.

10 MR. HASTINGS: Yeah, this is Peter
11 Hastings with DCS, and of course, I would concur with
12 Dr. Kress.

13 (Laughter.)

14 MEMBER POWERS: It's not going to help
15 you, Drew.

16 MR. HASTINGS: With the sole exception of
17 your distance to civilization remark, I think the --

18 (Laughter.)

19 MR. HASTINGS: -- highly accurate.

20 MEMBER KRESS: Yeah, I told him one state
21 away.

22 VICE CHAIRMAN WALLIS: Well, some people
23 might think the distance to civilization would be
24 several oceans.

25 MR. PERSINKO: This is Drew Persinko, the

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1 South Manager for the MOX facility.

2 I think you were accurate in your
3 presentation. I'd just like to point out to the full
4 committee a slight clarification, that when you showed
5 Part 70.61, you showed the consequences aspects of it,
6 but it's really what we call the performance
7 requirements which is a combination of consequences
8 with likelihood. So there's that aspect of 70.61 as
9 well.

10 MEMBER POWERS: Yeah, I started to go into
11 credible and incredible accidents and frequencies, and
12 I decided that even I didn't believe that.

13 VICE CHAIRMAN WALLIS: Okay. Thank you.

14 We now have another presentation from a
15 subcommittee chairman. That's George Apostolakis on
16 the integrated industry initiating event performance
17 indicator.

18 MEMBER APOSTOLAKIS: I have a conflict of
19 interest, Mr. Chairman.

20 VICE CHAIRMAN WALLIS: Yes, it's going to
21 be done by Bill Shack, Mario.

22 CHAIRMAN BONACA: Should I plug my ears
23 some?

24 PARTICIPANTS: No.

25 CHAIRMAN BONACA: Just keep silent.

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1 MEMBER POWERS: There will be no
2 snickering, sir.

3 CHAIRMAN BONACA: Do not speak unless
4 spoken to.

5 MEMBER APOSTOLAKIS: It's easy to say
6 nasty things about PRA because he can't say anything.

7 MEMBER SHACK: We had a subcommittee
8 meeting to review staff work on what they call the
9 industry initiating event performance indicator. The
10 development of this indicator is part of what is
11 called the industry trends program, and the industry
12 trends program is intended to complement the plant
13 level oversight provided by the ROP.

14 The ROP looks, of course, at a plant
15 specific kind of performance. The industry wide view
16 is sort of we had some discussion of what you would
17 learn from an industry-wide view since, again, a plan
18 has a problem; the industry has a problem.

19 But the thought was that the industry-wide
20 view could reveal trends that wouldn't be clear on a
21 plant specific basis, especially as we looked at
22 things like initiating events, which at least some of
23 them are fairly rare events, and if you looked at an
24 individual plant, you might wait some time before you
25 see them. If you pool the data on an industry-wide

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1 basis, you might see trends that wouldn't be revealed
2 on a plant specific basis.

3 The industry trends are also useful in
4 providing what is for the NRC a congressionally
5 mandated assessment of safety in the nuclear industry
6 in the country, and it was also argued they might
7 provide a context for considering the plant specific
8 results just like, again, looking at the plant
9 specific results in the context of industry
10 performance.

11 Now, the industry trends program is
12 presumably a larger set of indicators that will be
13 developed. This is, again, an ongoing program. So we
14 had a kind of a brief overview of the notion of an
15 industry trends program, this notion that we would be
16 looking at data and combining it to look at the
17 industry.

18 Then we looked at this one particular
19 indicator that they have been working on to develop
20 this so-called industry initiating event performance
21 indicator, and the initiating event indicator looks at
22 a fairly broad range of risk significant initiating
23 events, and again, we asked them just how they
24 selected the initiating events that they did, and it
25 doesn't appear that they had, you know, sort of a 95th

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1 percentile of all the risk due to initiating events,
2 but they were concluded to be the most important
3 initiating events.

4 They had nine events for BWRs, ten events
5 for PWRs because the PWR initiating event includes a
6 steam generator tube rupture, of course, which has no
7 analogy in a BWR.

8 MEMBER POWERS: But there are bypass
9 accident analogies in BWR.

10 MEMBER SHACK: Yeah, but this is really a
11 CDF driven thing. So this is an initiating event for
12 CDF.

13 MEMBER POWERS: Well, you know, somehow it
14 strikes me as a perversion of the idea of risk
15 informed regulation if you're going to ignore those
16 things that don't fit in the CDF as surrogate for
17 risk, and that's what happens. Bypass accidents don't
18 fit using CDF as a surrogate for risk because even
19 though their initiating frequencies can be low, their
20 risk is very high

21 MEMBER SHACK: At the moment they're
22 focusing on, again, some of the other initiating
23 events. They're looking at small break LOCA, loss of
24 instrument air, loss of feedwater, loss of heat sink,
25 stuck open SRVs, loss of off-site power, general

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1 transience.

2 Again, some of these events occur often
3 enough that you can get plant specific data. Others
4 are rare events, and you can get meaningful data only
5 on an industry-wide basis. And what they decided to
6 do for their performance indicator base was to use
7 industry average frequencies of these initiating
8 events.

9 So they would look at essentially all
10 instances of steam generator tube rupture in PWRs, all
11 instances of loss of off-site power for the families
12 of reactors.

13 They would then trend these frequencies.
14 So that would be one level of indicators, would be the
15 industry trends in these initiating event frequencies.

16 Now, again, that tells you something about
17 the trending of the initiating event, but the real
18 trick is to estimate the risk significance of these
19 trends, and they chose to do this by computing an
20 average CDF associated with these initiating events.

21 So you have one set of indicators, which
22 is really the trending of the frequencies. The other
23 is this average CDF. They compute the average CDF by
24 averaging over all plants as though the plant had the
25 industry average frequency of initiating event.

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1 So you take your industry average
2 initiating event frequency, and then you look and see
3 what the associated CDF per plant is with those
4 initiating events, and then average that CDF.

5 For a plant, you can compute the CDF
6 corresponding to the initiating events from the burn
7 bound importance measure for each initiator. These
8 important measures are computed from the staff SPAR
9 models.

10 You then, again sum those up for each
11 plant, and then you average them over all the plants.
12 You can interpret the resulting CDF as that due to a
13 plant with an average burn bomb importance and an
14 average frequency of initiating events.

15 Now, it turns out that the trending the
16 frequencies itself is not a trivial exercise. We have
17 a statistical variation in the number of events from
18 year to year that's just fluctuating.

19 In some cases over a ten to 15 year
20 period, there's a clear decreasing trend in the number
21 of events, but now we may have reached the plateau,
22 and they were trying to get a baseline.

23 Again, if we're looking for a trend, we
24 have to have a baseline to measure the trend against.
25 Their properties for a base was to use a long enough

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1 period to get a good estimate of the frequency and
2 short enough that the frequency over that period was
3 approximately constant.

4 They came up with some statistical rules
5 that allowed them to estimate these baselines for each
6 of the initiating events, and if you took those
7 baseline estimates of the frequencies of the
8 initiating events, then your average CDF for those
9 initiating events for BWRs was about one times ten to
10 the minus five for a reactor year, and it was
11 dominated by loss of off-site power, loss of heat sink
12 and feedwater.

13 Your baseline CDF for PWRs is 3.65 times
14 ten to the minus five per reactor year, and again,
15 that's dominated by small break LOCAs, loss of vital
16 DC bus and loss of off-site power.

17 They have, again, statistical rules to
18 compute their baselines. They compute the current
19 frequencies as three-year Bayesean running averages,
20 and so they can now have essentially a baseline for
21 the frequency. They have averages, current averages
22 that they can compute, and they can then begin to
23 establish as trends.

24 So what you get out of this analysis is a
25 current average value of the CDF, which in some sense

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1 is a measure of safety, and then you can begin to get
2 trends both in the average CDF and the initiating
3 frequencies which, again, tells you something about
4 performance in a sense.

5 Once you've established that you can
6 compute these trends in this average CDF, you'll also
7 have this question of, well, what does it mean. What
8 is a threshold? What does the trend mean, and how do
9 you set thresholds or measures of significance of the
10 trend?

11 That's a problem they haven't solved yet.
12 That's essentially, you know, work in development.
13 They plan to hold a public workshop in July to do
14 this. We will presumably get a chance to review that
15 work and to have some input into it before the final,
16 but again, this is a work in progress, and that's
17 basically the status that they've come up with, their
18 methods for computing the baseline values and the
19 trends, and now the question is to come up with
20 criteria for significance in the trends and the
21 baseline guidance.

22 Any of the others?

23 MEMBER SIEBER: Yeah, I think it's worth
24 adding why they're doing this in the first places.
25 One of the reasons that they're doing it is the one

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1 that Bill stated, which is there is a federal law that
2 requires the NRC to report to Congress abnormal events
3 and the safety status of the industry, and this is one
4 of the tools that they will use to do that, and it's
5 a little bit different than what they are currently
6 doing, which is basically reporting serious events
7 that occur without any analysis of trends.

8 The other thing is that they plan to use
9 it in a way that's quite similar to the matrix in the
10 ROP.

11 In other words, if the trend is basically
12 negative or steady, they will not take any regulatory
13 action, but as trends are identified which are
14 adverse, then they will go through a graded approach
15 to regulatory action, which would be first to engage
16 the industry to solve the problem; second, generic
17 communications to licensee; third would be generic
18 safety inspections to determine the root causes and so
19 forth for adverse trends; and then lastly, declaring
20 whatever issue caused the negative trend a generic
21 safety issue.

22 So this is the other half of why they're
23 doing this because, you know, just developing
24 performance indicators to put on the wall or in a
25 filing cabinet someplace is a lot of effort unless you

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1 do something with it, and that's what they plan to do.

2 MEMBER RANSOM: Well, just one comment.

3 It looks like this performance indicator is based on
4 a linear type model, in other words, the response
5 surface type approach that's used somewhat in
6 evaluating uncertainty in, you know, the existing
7 models.

8 And I would think this non-parametric
9 probability theory might be used here, you know, to
10 invoke some of the non-linearities of these initiating
11 events.

12 For example, like in some of the modern
13 systems where presumably the cord is not uncovered,
14 although there's, you know, some probability in the
15 frequency distribution of initiating events that the
16 core would uncover, but the derivative would be zero
17 for the most part, and then only in the extreme case
18 of some of these small, less probable aspects of the
19 event would it be, say, non-zero.

20 And I'm wondering how this would
21 incorporate that kind of an effect or does it only do
22 it in some average sense?

23 MEMBER SHACK: Certainly the argument is
24 that the CDF is linearly related to the initiating
25 event frequency through the burn bound measure.

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1 MEMBER SIEBER: Yeah.

2 MEMBER SHACK: It's not clear to me that
3 there's a non-linear relationship there.

4 MEMBER SIEBER: I would think it's linear.

5 MEMBER SHACK: You know, this may be a
6 case where the response surface actually is linear.

7 MEMBER RANSOM: Well, I wouldn't think --
8 just take some of the modern systems where core
9 uncovering (phonetic) is highly improbable, but if you
10 include the uncertainties involved in the estimation,
11 there is some at least small probability that the core
12 would be uncovered and core damage would occur.

13 VICE CHAIRMAN WALLIS: This isn't the
14 Burnbaum coefficient that's sort of integral of all of
15 that?

16 MEMBER SHACK: Yeah, right. I think the
17 Burnbaum coefficient would measure that.

18 MEMBER APOSTOLAKIS: But they're working
19 with BRA. BRA is linear in this work.

20 MEMBER SIEBER: Yeah, right.

21 MEMBER APOSTOLAKIS: You're referring, I
22 think, to physical phenomena where you have --

23 MEMBER RANSOM: Well, this is a partial
24 derivative of the possibility of core damage frequency
25 with respect to frequency of the --

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1 MEMBER APOSTOLAKIS: Oh, you mean
2 Burnbaum?

3 MEMBER RANSOM: Yeah, it's right here.
4 You know, the definition basically --

5 MEMBER APOSTOLAKIS: Yeah, but it's the
6 partial derivative of a linear function.

7 MEMBER RANSOM: Yeah.

8 MEMBER APOSTOLAKIS: The PRA is a linear
9 function of the --

10 VICE CHAIRMAN WALLIS: Yeah, you have
11 twice as many initiating events.

12 MEMBER APOSTOLAKIS: What?

13 VICE CHAIRMAN WALLIS: You have got twice
14 as many initiating events. You have twice as much
15 core damages.

16 MEMBER APOSTOLAKIS: That's right. Also
17 unavailabilities. It's linear in everything.

18 VICE CHAIRMAN WALLIS: It integrates out
19 all of these other things in PRA.

20 MEMBER APOSTOLAKIS: In fact, they take
21 the difference, don't they?

22 MEMBER SHACK: Well, they look at it both
23 ways, the difference or the absolute value.

24 MEMBER APOSTOLAKIS: No, I mean they don't
25 show a derivative.

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1 MEMBER SHACK: No, they don't show the
2 derivative. You're right.

3 VICE CHAIRMAN WALLIS: But they mention
4 the word "derivative."

5 MEMBER SHACK: You're right.

6 MEMBER APOSTOLAKIS: They do mention
7 derivative?

8 MEMBER SHACK: Yes, yes. I think the
9 problem is, of course, you don't walk into the SPAR
10 model and ask for a derivative.

11 MEMBER APOSTOLAKIS: Right, but why? I
12 don't understand it. Are they unhappy with other
13 measures? This is now an academic discussion.

14 VICE CHAIRMAN WALLIS: Therefore
15 important.

16 MEMBER SHACK: Well, I thought the
17 Burnbaum was a better measure. You're the PRA expert.

18 MEMBER APOSTOLAKIS: Better than what?

19 MEMBER SHACK: It was a more meaningful
20 measure because it didn't look at, you know, I take
21 one thing and I set it to zero and I take --

22 MEMBER APOSTOLAKIS: Oh, okay.

23 MEMBER SHACK: You know, and so, in fact -

24 -

25 MEMBER APOSTOLAKIS: So the next step in

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1 three years will be the differential measure which now
2 takes this and divides.

3 MEMBER POWERS: Gosh, that sounds like a
4 major breakthrough, doesn't it, George? It's only
5 been in the literature now how long?

6 CHAIRMAN BONACA: All right.

7 MEMBER APOSTOLAKIS: Very good. Well, I
8 take that back. I didn't say "very good."

9 MEMBER POWERS: So marginally adequate,
10 huh?

11 CHAIRMAN BONACA: You cannot say anything.
12 You're completely --

13 MEMBER APOSTOLAKIS: I can ask a question
14 for my own intellectual satisfaction.

15 CHAIRMAN BONACA: Yes, yes, sure. But you
16 cannot provide an answer.

17 (Laughter.)

18 MEMBER POWERS: Was that a statement of
19 permissiveness or ability?

20 CHAIRMAN BONACA: Both. No, no.

21 All right. With that we move to the next
22 item on the agenda. That's John is going to walk us
23 through future ACRS activities, a report of the
24 Planning and Procedures Subcommittee.

25 MR. LARKINS: Has everybody got a copy of

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1 the packet? I assume everybody has had a chance to
2 peruse through it.

3 PARTICIPANT: No. No, we didn't.

4 MR. LARKINS: And if there's no comments
5 we'll move on.

6 Okay. Let's go to the anticipated work
7 load for June. Well, let's look at May real quick.
8 We're finishing up the PRA letter this morning, and I
9 guess the vessel head penetration cracking and head
10 degradation letter and the Reg. Guide 1.178.

11 MEMBER SIEBER: Do we need a reporter for
12 this portion?

13 MR. LARKINS: No, no. We don't need you.

14 (Whereupon, at 9:32 a.m., the meeting in
15 the above-entitled matter was concluded.)
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CERTIFICATE

This is to certify that the attached proceedings
before the United States Nuclear Regulatory Commission
in the matter of:

Name of Proceeding: Advisory Committee on

Reactor Safeguards

502nd Meeting

Docket Number: n/a

Location: Rockville, MD

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