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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

December 15, 2004

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, taken on December 15, 2004, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 REACTOR FUELS SUBCOMMITTEE

7 + + + + +

8 WEDNESDAY,

9 DECEMBER 15, 2004

10 + + + + + +

11 ROCKVILLE, MARYLAND

12 + + + + +

13

14 The Subcommittee met at the Nuclear

15 Regulatory Commission, Two White Flint North, Room

16 T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Dana A.

17 Powers, Chairman, presiding.

18

19 COMMITTEE MEMBERS PRESENT:

20 DANA A. POWERS Chairman

21 MICHAEL T. RYAN ACNW Chairman

22 MARIO V. BONACA Member

23 ALLEN G. CROFF ACNW Member

24 RICHARD S. DENNING Member

25 F. PETER FORD Member

1 COMMITTEE MEMBERS PRESENT:

2 STEPHEN L. ROSEN Member

3 VICTOR H. RANSOM Member

4 JOHN B. SIEBER Member

5 GRAHAM B. WALLIS Member

6 RUTH WEINER ACNW Member

7

8 ACRS STAFF PRESENT:

9 MAGGALEAN WESTON

10

11 ALSO PRESENT:

12 DAVID BROWN

13 JOSEPH GIITTER

14 STU MAGRUDER

15 ALEX MURRAY

16 RENE PEDERSEN

17 BILL TROSKOSKI

18 REX WESCOTT

19

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

2 (8:31 a.m.)

3 CHAIRMAN POWERS: The meeting will now
4 come to order.

5 This is a meeting of the Advisory
6 Committee on Reactor Safeguards, Subcommittee on
7 Reactor Fuels. I'm Dan Powers, Chairman of the
8 Subcommittee.

9 In attendance for the ACRS are the members
10 Mario Bonaca, Richard Denning, Peter Ford, Victor
11 Ransom, Steve Rosen, Jack Sieber, Graham Wallis.
12 We're also being ably assisted by members of the
13 Advisory Committee on Nuclear Waste, Allen Croff,
14 Michael Ryan, Ruth Weiner.

15 The purpose of the meeting is to discuss
16 the mixed oxide fuel fabrication facility construction
17 authorization application and the staff's draft final
18 safety evaluation report. The subcommittee, of
19 course, will be gathering information, analyzing
20 relevant issues and facts in order to formulate a
21 proposed position and action as appropriate for
22 deliberation by the full ACRS.

23 Mag Weston is the cognizant ACRS staff
24 engineer for this meeting.

25 The rules for participation in today's

1 meeting have been announced as part of the notice of
2 this meeting previously published in the Federal
3 Register on December 8th, 2004. A transcript of the
4 meeting is being kept and will be made available as
5 stated in the Federal Register notice.
6 It is requested that speakers first
7 identify themselves and speak with sufficient clarity
8 and volume that they may be readily understood.
9 We have received no written comments from
10 members of the public regarding today's meeting.
11 This is, I believe, the third meeting of
12 the Reactor Fuel Subcommittee on the MOX facility, and
13 what we're going to be looking at is the safety
14 evaluation report that the staff has put together on
15 this facility.
16 In setting up the meeting, we set it up
17 not to spend a lot of time on the general layout and
18 design of the facility since most of the members of
19 the Reactor Fuel Subcommittee have been through this
20 facility at some length.
21 Some of the people who have not done that
22 that, I understand, have made heroic efforts to bring
23 themselves up to speed on this, and I thank you very
24 much for doing that.
25 What we would like to get out of this

1 subcommittee meeting is a strategy of action in
2 preparation for presentations to the full committee.
3 So we really are trying to put together a proposed
4 position and plan of action for that full subcommittee
5 meeting that we now anticipate will take place in
6 February. So there are some, especially tomorrow,
7 protracted periods for subcommittee discussions.
8 Now, the members have received, I'm told,
9 2,700 pages of information, some of which is brand
10 new, 555 pages of which is brand new, and some of
11 which has been amended from what they've seen in the
12 past, and I think there is no chance that members have
13 digested all of that in completion, except for Mr.
14 Sieber, who I know is encyclopedic in his knowledge on
15 the subject.
16 So in setting up our proposed actions, we
17 may well have to allow time to plunge in to examine
18 material more carefully. One of the possibilities, of
19 course, is that we may need to get together again to
20 refine our positions, but I would very much like to
21 come out of this meeting with a pretty good outline of
22 what a letter on this facility would actually look
23 like.
24 I don't intend to actually craft language,
25 but an outline I would like to get, and that may

1 involve members of the subcommittee taking assignments
2 to develop a paragraph here and there, and the like.
3 Are there any comments from other members?
4 (No response.)
5 CHAIRMAN POWERS: Seeing no one anxious to
6 speak on this hot topic on a chilly day, I think we
7 can go ahead with the meeting. Is David going to
8 start off or is Joe?
9 MR. BROWN: Joe is going to start off.
10 CHAIRMAN POWERS: Okay, Joe. Joe, you're
11 on.
12 MR. GIITTER: Thank you.
13 My name is Joe Giitter. I'm the Chief of
14 the Special Projects Branch, which is doing the safety
15 review of the mixed oxide fuel fabrication facility.
16 The last time we met with you was in
17 November of 2003, over a year ago, and at that time we
18 had just learned from DCS, the applicant, that they
19 had been directed by DOE to make another significant
20 change in the construction authorization request for
21 the proposed facility.
22 That change involved reducing the
23 boundaries of the controlled area from an area that
24 corresponded to roughly the Savannah River site
25 boundary, which was about five miles from the facility

1 at its closest point down to an area 160 meters from
2 the stack.
3 In June of this year, the NRC received a
4 revised construction authorization request from the
5 applicant to reflect these changes.
6 Another change since we last met with you
7 is we have a new project manager, Dave Brown. Mr.
8 Brown this morning will provide an overview and status
9 update on the MOX program, and he'll describe in more
10 detail the staff's review of the applicant's revised
11 CAR.
12 The staff has completed a draft of the
13 final safety evaluation report, which was provided to
14 you on November 26th. The draft FSER contains no
15 remaining open items and the staff has concluded that
16 the applicant has met the safety requirements
17 necessary for the issuance of a construction
18 authorization.
19 As you will recall from the last meeting,
20 there were about a dozen open issues remaining,
21 primarily in the area of chemical safety. Today we
22 will discuss in more detail the basis for closing
23 those open items. We plan to issue a final SER in
24 February and request a letter from the full committee
25 to the Commission supporting the staff's conclusions

1 by that time.

2 We are planning to brief the full

3 committee in February, as you had indicated, Dr.

4 Powers.

5 Following our presentation and later this

6 afternoon, Mr. Murray, one of the chemical safety

7 reviewers for the MOX facility will discuss the open

8 issues, two of the issues that he has that have been

9 handled through the differing professional view and

10 opinion process.

11 As you are aware, the agency recently

12 modified its process for handling differing

13 professional views and opinions. One change is that

14 the Office of Enforcement is now the focal point

15 within the agency for coordinating differing

16 professional opinions.

17 Rene Pedersen, the DPO Program Coordinator

18 from the Office of Enforcement will be here this

19 afternoon to answer any questions about the new

20 process and will also be prepared to discuss the

21 status of the DPS file related to the MOX fuel

22 fabrication facility.

23 And that concludes my opening remarks.

24 CHAIRMAN POWERS: Let's see. You indicate

25 that you have no open items.

1 MR. GIITTER: That's correct.

2 CHAIRMAN POWERS: Could I call your

3 attention to page 5.0-15 of the SER, last line on the

4 page?

5 MR. GIITTER: I'm aware of that. There

6 are some areas within the draft FSER where it still

7 states that there are open items, and that was an

8 oversight on our part.

9 CHAIRMAN POWERS: You recognize that it

10 makes a fair amount of challenge for us to review a

11 document on which we have statements to the effect

12 that they don't meet a particular part of the 10 CFR

13 regulations?

14 I mean that's fairly challenging for us to

15 read the material and then say, "Well, that doesn't

16 count," because there's not a mark on it that says

17 this is an oversight.

18 MR. GIITTER: Yes, well, we understand

19 that. We can provide a revised --

20 CHAIRMAN POWERS: Can you flag those for

21 us or do something that says this statement doesn't

22 count?

23 MR. BROWN: I think we've already received

24 some of those comments back, and we can certainly do

25 that. Just make sure that you're aware of editorial

1 changes.

2 CHAIRMAN POWERS: I mean, I come to that

3 sentence and said, "Good. I don't have to read this

4 anymore," and put it aside.

5 MR. BROWN: Right.

6 MR. BROWN: We'll definitely work with Mag

7 to make sure, especially when we're changing the

8 meaning of the sentence, that you're aware of it.

9 CHAIRMAN POWERS: Actually it produced a

10 much different response from me. I don't have to read

11 this. I have to come up with what are they asking me

12 for, to resolve these issues for them one way or

13 another?

14 I mean, this particular statement creates

15 a lot of work.

16 MR. BROWN: Yes, I apologize for those

17 statements. We will certainly keep you informed as we

18 go through the process of making those final edits

19 until February.

20 I want to thank you, Dr. Powers and the

21 members for this opportunity to speak with you.

22 This is, as we pointed out, our

23 opportunity to ask you for your endorsement of our

24 safety evaluation. I do want to provide a brief, but

25 fairly comprehensive overview of the project,

1 especially for those of you who may be new to the
2 project. I'll talk about briefly why we're here and
3 the status of the project and the progress of the
4 project since roughly 2000.
5 The purpose is, as we stated, to seek your
6 endorsement of the staff safety evaluation, unlike the
7 previous two meetings where we were merely providing
8 you information on the status of the staff's review.
9 CHAIRMAN POWERS: Yes. You understand
10 that the ACRS will not give you an endorsement at this
11 meeting?
12 MR. BROWN: Yes, I do.
13 CHAIRMAN POWERS: That the subcommittee
14 will only evaluate the material, draft a position --
15 MR. BROWN: I understand.
16 CHAIRMAN POWERS: -- and come up with a
17 strategy?
18 MR. BROWN: And this perhaps should have
19 been clear to say to provide information towards
20 seeking your endorsement. I realize this is an
21 ongoing process.
22 DR. WALLIS: I'm not quite sure how I
23 would give an endorsement. I read all of these pages.
24 I was looking for technical information with equations
25 and criteria and things like that, and I didn't find

1 it.

2 CHAIRMAN POWERS: Well, you're --

3 DR. WALLIS: So I don't know what I'm

4 endorsing.

5 CHAIRMAN POWERS: You're looking too early

6 in the process.

7 DR. WALLIS: Too early in the process?

8 CHAIRMAN POWERS: Yeah. You will see

9 equations and whatnot in the integrated safety

10 assessment for the license application.

11 DR. WALLIS: Later?

12 CHAIRMAN POWERS: Yeah. This is just

13 establishing the design basis.

14 MR. ROSEN: I look at this as an immense

15 number of promises for the future.

16 MR. BROWN: There are many of those,

17 commitments for future license application, which we

18 are expecting this spring, and I'll get into that as

19 I complete my presentation, how we're doing things in

20 two stages, as it were.

21 CHAIRMAN POWERS: And if you want

22 quantitative performance criteria, 10 CFR 70.6.1 and

23 4.

24 MR. BROWN: Yeah, 70.61

25 CHAIRMAN POWERS: Sixty-one and 64 or

1 something like that?

2 MR. BROWN: I'm sorry?

3 MR. GIITTER: Seventy, sixty-four is

4 baseline design criteria, which is akin to the general

5 design criteria in Part 50.

6 DR. WALLIS: I guess we might get into

7 some of the technical issues later then.

8 MR. BROWN: Oh, we will. Yeah, I'll try

9 to conclude my remarks as briefly as I can, but we'll

10 get right into the technical issues.

11 DR. BONACA: The other place where I have

12 difficulty with this was in some of the areas where,

13 you know, the applicant claims preventative actions as

14 a means of providing defense and protection, and it's

15 not clear to me when I read it if those actions are

16 going to be automatic or built into the process so

17 that there are physical reasons why you will not have

18 a challenge, or if they are tied to human action.

19 Now, then I have difficult in the sense

20 that what does it take to approve a construction

21 process. Okay? I mean, if I'm saying that certain

22 considerations to prevent an explosion seem to be

23 appropriate or there is no statement that says it will

24 be considered, you know, this is good enough to

25 approve the construction process, does it mean that

1 any means of deliberate action is going to be
2 acceptable or is it going to be an issue to be dealt
3 with at the operation review phase?
4 MR. BROWN: No, rarely did we accept the
5 commitment that any means of preventing the accident
6 would be acceptable. We did require pretty detailed
7 information on what the system structure or component
8 was that prevented the accident or would prevent and
9 what its function is and then an additional level of
10 detail is what is its design basis.
11 DR. BONACA: No, I understand that.
12 MR. BROWN: What pressure would not be
13 exceeded? What temperature would not be exceeded?
14 DR. BONACA: It troubled me the fact that
15 there was no discussion of operators involved. So I
16 couldn't tell how these actions would be accomplished.
17 I mean some of them may be automatic. Some of them
18 may be -- that's a fundamental issue, too, the risk.
19 MR. BROWN: I understand your comment.
20 Certainly our preference is that engineered controls
21 be selected over human controls.
22 DR. BONACA: Yeah, and we will have some
23 opportunity as you go through the open items to --
24 MR. BROWN: I think as we go through each
25 one we'll see specific instances where you be able to

1 raise that point. I believe it will answer your
2 question.
3 CHAIRMAN POWERS: I believe the Code of
4 Federal Regulations require a bias in favor of things
5 other than administrative controls.
6 MR. BROWN: that's right. There is a
7 preference actually stated in our regulations.
8 I'll say that what we're doing here is the
9 Department of Energy is implementing this agreement
10 with Russia to disposition 34 metric tons so that the
11 point here is that the Department of Energy is the
12 owner of the mixed oxide fuel plant. NRC is
13 regulating it, and then there's a third party, the top
14 bullet here.
15 The Department of Energy and National
16 Nuclear Security Administration selected Duke Cogema
17 Stone and Webster to design, build, and operate this
18 plant. They are the applicant, and they would be a
19 future licensee, not the Department of Energy.
20 And when the program was first conceived,
21 there was the concept of an immobilization plant where
22 about eight and a half metric tons of plutonium was to
23 be immobilized, not turned into MOX fuel. As of April
24 2002, now all 34 metric tons will be converted to MOX
25 fuel, which means there are now two plutonium

1 disposition facilities.

2 One is the pit disassembly and conversion

3 facility, again, owned by DOE, designed, built and

4 operated by a DOE contractor, not DCS, and then the

5 mixed oxide fuel fabrication facility.

6 The pit disassembly and conversion

7 facility would receive weapon components, convert

8 those components to plutonium dioxide, which is then

9 feed material for the MOX facility, which would be

10 next door.

11 CHAIRMAN POWERS: Is the pit disassembly

12 and conversion facility -- does it actually exist?

13 MR. BROWN: It does not exact yet either.

14 In fact, the plan is that the initial feedstock for

15 the MOX facility would be existing plutonium dioxide

16 surplus, and that the pit disassembly and conversion

17 facility will actually be brought on line after the

18 MOX plant to provide the remainder of the 34 metric

19 tons.

20 CHAIRMAN POWERS: I suppose then it is

21 fairly difficult at this stage to assess whether an

22 event at the PDCF affects activities at the MFFF.

23 MR. BROWN: At this point, you know, we

24 have not identified and the CAR does not identify

25 events at the proposed PDCF. We would expect that to

1 be considered in the future integrated safety analysis
2 that will be provided next spring with the license
3 application.
4 And it would be expected to consider all
5 nearby industrial facilities, nuclear and industrial
6 facilities.
7 This is just essentially an artist
8 rendering of what I just said, which is essentially
9 the blue boxes on the left are the DOE owned and
10 regulated activities, and then the mixed oxide fuel
11 fabrication facility DOE owned, but NRC regulated, and
12 then, of course, the reactors are commercially owned
13 NRC regulated.
14 MR. ROSEN: Is your slide right? You've
15 got -- oh, okay, yes. The NRC's regulation is on the
16 yellow.
17 MR. BROWN: Right.
18 DR. WALLIS: So how many tons are going
19 into Catawba and McGuire?
20 MR. BROWN: Well, what it is is the
21 conversion of 34 metric tons of plutonium that's
22 plutonium metal.
23 DR. WALLIS: That's from each?
24 MR. BROWN: To fuel.
25 DR. WALLIS: Is it 34 or 68?

1 MR. BROWN: Thirty-four total So each
2 reactor, I don't know that it's divided perfectly in
3 half, but let's say that it is. So each reactor gets
4 17.
5 DR. WALLIS: Gets 17.
6 MR. BROWN: Certainly more than one core
7 reload. It goes on for several years, many years.
8 CHAIRMAN POWERS: And the facility itself
9 has a finite lifetime, is my understanding.
10 MR. BROWN: Yes. The reactor facilities.
11 CHAIRMAN POWERS: I mean the fabrication
12 facility. Once this campaign is over, that facility
13 is to be retired?
14 MR. BROWN: The facility will be
15 deactivated, in the DOE parlance, and then they could
16 be turned back over to DOE for decommissioning.
17 DR. WALLIS: Well, they might even be some
18 more excess plutonium by then.
19 MR. BROWN: We could speculate, yeah, that
20 there would be more mission for this facility later
21 down the road, especially given the additional
22 unilateral strategic arms reductions.
23 CHAIRMAN POWERS: It seems to me that
24 understanding the design lifetime in the facility is
25 important, and then understanding the design basis.

1 MR. BROWN: It is certainly a
2 consideration, especially where aging effects have to
3 be considered on materials. And so, you know, if, for
4 example, it was intended that the vessel would not
5 need any maintenance for the duration of the mission,
6 you would have to take that into consideration, sure.
7 This is a flow chart that's indicating
8 roughly how we're performing this review. You'll see
9 on the top row there that, you know, the third box
10 from the left is ACRS review, and that's where we are,
11 the first review by the ACRS of the staff's review of
12 the construction authorization.
13 We plan to issue the EIS and the SER in
14 January-February of 2005, and then we will continue on
15 with the construction hearing at that point.
16 DR. WALLIS: When is it that we get to
17 look at these equations?
18 MR. BROWN: I think the more your review
19 of our evaluation of the integrated safety analysis
20 is --
21 DR. WALLIS: Down there.
22 MR. BROWN: -- in a corresponding
23 position, you know. You followed our construction
24 authorization review and --
25 DR. WALLIS: This was already being built

1 by then?

2 MR. BROWN: It will have been probably

3 partially built. I doubt that it will have been

4 completed by that point, although I'm speculating

5 somewhat. We're anticipating a two-year review

6 starting this spring, and with a construction start

7 later than early summer of 2005, it's possible we

8 could finish the license review before they finish

9 building the plant.

10 MR. ROSEN: It would be helpful to me to

11 have more than just the postage stamp size picture of

12 this slide. Right now all we have is that.

13 MR. BROWN: Only that.

14 MR. ROSEN: It's pretty hard to read.

15 MR. BROWN: Okay. I can certainly for the

16 record provide the larger slides. I'll work with Mag

17 on that.

18 MR. GIITTER: We can probably get copies

19 at the break and give them to you.

20 MR. ROSEN: Yeah, just of this one is all.

21 MR. GIITTER: Sure.

22 MR. BROWN: As we indicated in that flow

23 charge, there will be two approvals, the construction

24 permit and then the license to possess and use

25 licensed material.

1 What's required for a construction permit
2 is what I've cited there on that regulation. The
3 applicant must provide a safety assessment of the
4 design bases of principal structure, systems and
5 components, a description of the quality assurance
6 program, and we, NRC, have written an environmental
7 impact statement based on the applicant's
8 environmental report.
9 For the purpose of this review, we've
10 adopted the Part 50 definition of design basis, and
11 this is really what has guided these years of review
12 of the construction authorization. We're proving the
13 function that a structured system and component has
14 and the values for controlled parameters.
15 So, for example, the function might be to
16 prevent a rupture of a vessel. The control parameter
17 is pressure. Design basis value might be 100 psi.
18 That's the extent of the information we would be
19 approving at this point, and that, for example, would
20 not include the location of the vessel, its size, its
21 shape and that sort of thing.
22 DR. WALLIS: Well, is there anything in
23 this which gives assurance that these controlling
24 parameters can control what's going on in this
25 structure, system, or component?

1 MR. BROWN: That's of course, what the
2 applicant must do. They must be able --
3 DR. WALLIS: But we don't at this time get
4 that assurance?
5 MR. BROWN: We don't have --
6 DR. WALLIS: Sort of promise that they'll
7 be able to do it; is that what we get?
8 MR. BROWN: Well, in some cases these
9 things are well known. For example, an acceptable
10 design basis can be an industry code and standard.
11 It's a consensus standard.
12 DR. WALLIS: There may be some things that
13 are well known, but there may be other things where
14 the chemical reactions are rather complicated and
15 controlling them may not be as simple as simply
16 specifying some numbers.
17 MR. BROWN: Right, and we will have
18 examples of those, too, as we go on where, for
19 example, the values for the control parameters are
20 based on industry experience and some research. Given
21 even that, the applicant has committed to do
22 additional research to support those values.
23 DR. FORD: The chemical plant, nuclear
24 plant, you have all underground, time dependent
25 materials degradation issue, which must impact,

1 therefore, on the design basis. Where do we hear
2 about those specifics?
3 What's your materials degradation
4 mechanism and how does that impact on your margins, et
5 cetera, according to your design basis? When do we
6 hear about that?
7 MR. BROWN: Where the materials
8 degradation is an important part of the reliable
9 function of a principle SSC, that's when we would look
10 for those details.
11 In some cases, for example, what I mean by
12 that is if the safety function is to contain a
13 potential release, say, resulting from a corrosion
14 event, what we're focused on is that mechanism, that
15 SSC that's containing the release in a process cell
16 and we may not be focused just on the corrosion of the
17 pipe in the process cell.
18 In other words, we'd be looking at --
19 DR. FORD: I'm still stuck trying to hear
20 the answer to my question. When are we going to hear
21 being exposed to the specific data upon which you
22 determine how quickly it is that a component is going
23 to degrade?
24 MR. BROWN: Well, most of that information
25 will be -- that sort of detailed information will be

1 provided in the integrated safety analysis with the
2 license application this spring.
3 MR. GIITTER: I think it's important to
4 point out, too, that what we're looking at, Part 70,
5 was developed with a one step licensing process in
6 mind, and Dave is going to talk about that, but what
7 we're doing here with the MOX facility is unique.
8 We're actually doing a two-step licensing process
9 under a regulation that was intended to be used for a
10 one-step licensing process.
11 So at this point the only thing the staff
12 is doing and the applicant has to provide us with is
13 the design basis for the principal structure, systems,
14 and components that are really controls to insure that
15 the facility will be designed against natural
16 phenomena and accidents.
17 And Dave will talk about that in more
18 detail in a minute.
19 DR. FORD: But are there any lessons being
20 learned from the chemical industry, for instance?
21 They're very sophisticated when it comes down to
22 evaluating materials degradation and how that impacts
23 on the design of their plant.
24 Are there lessons learned being taken from
25 that industry to this?

1 MR. MURRAY: Yes, if I could just comment
2 very quickly. I'm Alex Murray. I'm the lead chemical
3 safety reviewer.
4 Just to let you know, there are several
5 codes and standards which have been identified as
6 design bases for addressing corrosion concerns. Those
7 codes and standards have methodologies for deriving
8 specific corrosion monitoring, maintenance, and/or
9 replacement programs.
10 For the construction permit stage, they
11 tend to be top level. Is this sort of thing generally
12 done in the chemical process industries or the nuclear
13 industry? Are known corrosion phenomena being
14 addressed?
15 And overall, at a design basis level the
16 staff has concluded they are, and this is written up
17 in the draft FSER.
18 DR. FORD: So it details such as titanium
19 versus carbon steel, for instance?
20 MR. MURRAY: Titanium versus 304/316
21 stainless steel would be a good one, yes.
22 DR. FORD: And that would be spelled out
23 at this stage or not until the spring of next year?
24 MR. MURRAY: Top level selection of
25 materials for components has been spelled out in the

1 construction permit. Specific details, such as time
2 of surveillance, such as actual corrosion rates,
3 presence or absence of corrosion type probes,
4 corrosimeters, and so forth on the staff would expect
5 those in the license application in this coming
6 spring.
7 DR. FORD: Okay. So we won't see that
8 data until then.
9 MR. MURRAY: You will not see specific
10 data. You will see there are specific controls in the
11 revised application, which the applicant has
12 identified for addressing corrosion concerns.
13 For example, the destruction of the silver
14 II species so that it is not capable of corroding
15 stainless steel components downstream, as an example.
16 Does that answer your question?
17 DR. FORD: It answers my question, but it
18 really does worry me that it's fairly late in the
19 proceedings that we start to look at the details of
20 the degradation mechanisms. Forget anything else, and
21 from a business point of view, it's pretty darn late
22 for people to be making decisions about --
23 CHAIRMAN POWERS: Business points of view,
24 of course, are outside our domain.
25 DR. FORD: Pardon?

1 CHAIRMAN POWERS: Business points of view
2 are outside our domain.
3 DR. FORD: Oh, I recognize that, Dana,
4 absolutely, but it does come into our personal
5 thinking as to how you evaluate this.
6 MR. MURRAY: Yes, and I think with this
7 being a two step approach, a construction permit
8 followed by an operating license application, I think
9 we get, if you will, the best of both worlds. We get
10 an initial general look at does this seem
11 qualitatively in alignment with what industry actually
12 does, with the top level corrosion phenomenon, et
13 cetera. Details will come forward in the license
14 application.
15 DR. FORD: Jolly good.
16 MR. SIEBER: Actually this kind of a plant
17 is not a new concept. It seemed to me that solvent
18 extraction and Purex type plants have been around for
19 some years.
20 CHAIRMAN POWERS: And they pre-date me.
21 I know that.
22 MR. SIEBER: Well, unfortunately they
23 don't pre-date me.
24 (Laughter.)
25 MR. MURRAY: They pre-date me, too, but

1 I'm only 29.

2 MR. BROWN: Thanks, Alex.

3 MR. MURRAY: You're welcome.

4 MR. BROWN: I just wanted to point out

5 quickly that you may ask the question: why don't we

6 identify what's a principal structure system and

7 component and what isn't. In the safety assessment if

8 the event is not unlikely, if it's a likely event,

9 which for this applicant is always their first

10 assumption, that this event could happen, and as a

11 high consequence, then that, of course, appears in the

12 bin in the upper right.

13 And the goal is then to drive it down to

14 the lower left. Then --

15 DR. WALLIS: I'm sure we asked you before

16 what likely and unlikely mean.

17 MR. BROWN: Yes. And for this application

18 that's defined qualitatively, unlikely is --

19 DR. WALLIS: Is it once a week, once a

20 year, once a century?

21 MR. BROWN: Not likely to occur during the

22 operation of the plant. It is unlikely.

23 DR. FORD: Is that 40 years?

24 MR. BROWN: In this case the actual

25 mission will be finished in something under 14 years.

1 DR. FORD: So highly unlikely means it
2 wouldn't occur if the plant were run for 1,000 years
3 or something?
4 MR. BROWN: Well, highly unlikely would
5 be, again, defined qualitatively as, you know --
6 DR. WALLIS: Qualitatively doesn't mean
7 anything to me though.
8 MR. BROWN: And we've had this discussion
9 before.
10 DR. WALLIS: Sure, we have.
11 MR. BROWN: You're right. We're not
12 requiring a quantitative --
13 DR. WALLIS: So you refused to define
14 "likely."
15 MR. BROWN: I'm sorry?
16 DR. WALLIS: You define consequence here
17 with numbers.
18 MR. BROWN: WE did.
19 DR. WALLIS: But you don't define
20 likelihood.
21 MR. BROWN: And that is how the regulation
22 is written.
23 DR. WALLIS: Us there something tabu about
24 that? The word "probability" is impermissible?
25 MR. GIITTER: It's permissible to use a

1 quantitative approach if you read Part 70, and the
2 guidance associated with Part 70 in NUREG 1718, which
3 was developed specifically for MOX.
4 However, the applicants also are allowed
5 the option of using a qualitative approach, and in
6 fact, most of the fuel cycle -- in fact, all of the
7 fuel cycle licensees have taken qualitative or semi-
8 qualitative approach.
9 And part of that is you just don't have
10 the type of data that you would have with a reactor
11 facility and a fuel cycle facility. You rely more
12 heavily on administrative controls, on human action
13 than you would in a nuclear power plant.
14 DR. BONACA: That's why I had difficulty
15 when I was reading.
16 DR. WALLIS: Well, it's appropriate, I
17 think, at the level of 10 CFR 70, that there be some
18 vagueness. It's very appropriate.
19 But when you're looking at a specific
20 plant, maybe you need to be more definite about how
21 you interpret those terms.
22 MR. BROWN: At this point we have accepted
23 the qualitative definitions. That doesn't preclude,
24 as Mr. Giitter points out, that later in the
25 integrated safety analysis there are other methods for

1 safety analysis that are more quantitative, and in
2 this case, DCS may use those to make their case.
3 DR. BONACA: For reactor facilities, you
4 know, the '60s and '70s they used also qualitative
5 definitions frequently and frequent and so on, but
6 there were some of understanding. For example,
7 frequent meant -- infrequent meant that it would
8 happen maybe once in the life of the plant.
9 MR. BROWN: That would correspond to our--
10 DR. BONACA: I'm trying to understand the
11 difference between highly unlikely and unlikely. I
12 mean for unlikely would you have an expectation that
13 possibly it could happen once in the life of a plant?
14 MR. MURRAY: There is guidance on
15 likelihoods provided in the standard review plan for
16 MOX which is NUREG 1781 and also in the standard
17 review plan for fuel cycle facilities in general,
18 which is NUREG 1520. Very round numbers, unlikely
19 means basically one event, one potential event, in
20 round numbers 100 years to perhaps 1,000/10,000 years,
21 and the upper bound for highly unlikely is generally
22 given a numerical number somewhere ten to the minus
23 four, ten to the minus fifth per year or one in 10,000
24 to one in 100,000 years.
25 DR. BONACA: Okay.

1 MR. MURRAY: That's in the guidance. It's
2 not in the regulation. That gives you some feel for
3 it.
4 DR. BONACA: Some feel for it. Okay. So
5 unlikely you said it's possible once in the life of
6 the plant. Maybe.
7 MR. BROWN: Well, for this application
8 it's not likely to occur --
9 MR. MURRAY: In the plant, yes.
10 MR. BROWN: -- during the life of the
11 plant.
12 DR. WALLIS: That's a dangerous definition
13 because an accident which destroys the plant is only
14 going to occur once in a life of the plant.
15 MR. MURRAY: Well, that's why the guidance
16 does give some numerical bounds.
17 DR. WALLIS: I like your numbers. Thank
18 you.
19 MR. MURRAY: Oh, you're welcome, sir.
20 MR. BROWN: And so where we are is we did
21 get this construction authorization request in 2001.
22 We have had issued two draft safety evaluation
23 reports, and last year we met with the full committee.
24 There were 11 remaining open items in the draft safety
25 evaluation report, and at that point there was also,

1 as Mr. Giitter pointed out, DOE had just announced it
2 was going to change its controlled area boundary,
3 which was significant because that was a point at
4 which the doses were calculated for the safety
5 assessment.
6 And so you know, that is a picture of the
7 entire Savannah River site in South Carolina. I
8 realize it's not terribly easy to get the perspective
9 from that scale, but that's roughly 300 square miles
10 of territory, and so a member of the public, that
11 evaluation point was some five miles away from the
12 facility, but now the controlled area boundary is
13 essentially contiguous with the site boundary.
14 The site is the box on the left side.
15 That's the MOX fuel fabrication facility site. The
16 site down to the lower and to the right is the pit
17 disassembly and conversion facility site. The MOX
18 site is about 41 acres. So that now is the controlled
19 area, and the evaluation point for an individual at
20 that controlled area boundary is only 160 meters away
21 rather than five miles.
22 So they made that announcement in November
23 of last year and by June of this year had revised the
24 construction authorization request. There was one
25 additional principal system structure component as a

1 result of the change, which is now the process cell
2 exhaust system, is a PSSC.
3 The reason there was only one change is
4 because there was already a large amount of margin in
5 the safety assessment. So moving the boundary really
6 did not result in significant changes to the outcome
7 of the safety assessment.
8 There were some other changes. DOE and
9 DCS took the opportunity from November to June of this
10 year to remove the uranium oxide dissolution system.
11 The original concept was for depleted uranium oxide to
12 be delivered to the plant, and where it needed or DCS
13 needed to make up uranyl nitrate solutions, they would
14 just simply dissolve the dioxide.
15 Now rather than do that, they will receive
16 uranyl nitrate as a reagent.
17 There's an additional unit for dealing
18 with the waste solvent from the Purex cycle. They did
19 slightly modify their chemical inventory list, and as
20 a result of some refinements in the process chemistry,
21 of course, that results in an update in your waste
22 stream inventory. So that was updated.
23 By the time of the June 2004 CAR, we had
24 closed several of the open items. So those are now
25 reflected in the June 2004 CAR as I've listed here,

1 and, of course, I've made some other corrections.

2 At this point if we do approve the CAR, in

3 February we will start construction inspections. We

4 have been working with regional office to set up a

5 construction inspection program, and of course, really

6 DCS will be treated as a licensee. Even though they

7 have a construction permit, for all other purposes

8 they're essentially treated as a licensee.

9 Shortly after that, they plan to follow a

10 license application and ISA summary and all the other

11 application materials that would be required for

12 facility security and so forth.

13 So without further delay, I'd be happy to

14 answer any additional questions. I'll allow the

15 technical review staff to give their presentations,

16 starting with Mr. Murray. Are there any other

17 questions for me at this point?

18 CHAIRMAN POWERS: It's important to

19 understand the basic philosophy here, that under shall

20 we say ordinary circumstances you would never see this

21 stage of the operation. You would see the stage

22 where they are granted a license to receive and hold

23 special nuclear materials. So this is kind of a sneak

24 peek in on the process in which we're really focusing

25 on what the hazards are and what the design bases for

1 a material or any steps taken to control those
2 hazards.
3 Now, it seems to me, Dave, it might be
4 useful to point out that in your slide where you had
5 the unlikely and likely in consequences, those are
6 consequences, unmitigated consequences that are used
7 to assess whether mitigation or prevention is needed.
8 MR. BROWN: That's right. I mean, your
9 determination of what's acceptable and not acceptable
10 is based on, first, the unmitigated consequences. In
11 other words, you're analyzing a preliminary design
12 based on what's there, and then if you're in the not
13 acceptable bin, you're adding system structures and
14 components to produce the risk of that hazard, those
15 new things or the principal structure systems and
16 components.
17 CHAIRMAN POWERS: It seems to me that it's
18 also useful to explore just a little bit what the
19 safety philosophy is because the regulations require
20 a defense in depth type of approach, and that gets
21 crated in the structure of the facility. So it is not
22 uncommon for the applicant, when he identifies
23 something as being unacceptable to take a preventive
24 approach because his inherent mitigation is already
25 built into the structure of the facility.

1 So it can appear in the responses that
2 there's an imbalance between prevention and
3 mitigation, but that's because the mitigation has
4 already been built into the construction of the
5 facility.
6 MR. BROWN: Right. It really does become
7 an issue of, I think, as you said, philosophy. For
8 example, when we're looking at a particular event, it
9 may be that in a way, the safety assessment is written
10 it looks as though only a preventive feature is
11 credited to, for example -- where do I -- in other
12 words, to get to that bin. In other words, there
13 doesn't appear to be any credit taken for mitigative
14 features in the facility, but under the defense in
15 depth concept, there really are in almost all cases
16 mitigative features, and namely, for this facility
17 that's the confinement ventilation system, the HEPA
18 filters, if you will, and the tertiary confinement of
19 materials.
20 For disbursable materials in this plant,
21 there will be at least three boundaries of
22 confinement. So the fact that I may have only
23 credited philosophically, you know, the preventive
24 feature does not in anyway mean that there aren't
25 other features present. That's right.

1 And usually what it is is the HEPA
2 filters, if you will, the confinement barriers are
3 also credited, but for other events, and what we'll
4 see in the future I would think with the integrated
5 safety analysis is a little more integration of those
6 things, where we understand the effects of -- you
7 know, that certain components will be there to prevent
8 all sorts of different hazards.
9 CHAIRMAN POWERS: Allen.
10 DR. CROFF: One thing I was unable to find
11 in reading through this mass of paper is what I'll
12 call the operation and maintenance philosophy and how
13 that is factored into the design of this plant, and
14 that's in consideration of occupational dose, in ALARA
15 and how the plant is designed to facilitate that.
16 Is that in there or do we know this
17 philosophy and how they're approaching it?
18 MR. BROWN: We do know it, and the
19 information is contained in Chapter 9 of the
20 construction authorization request for radiation
21 protection. It is also contained elsewhere.
22 DR. CROFF: Which would mean?
23 MR. BROWN: Because a fundamental design
24 philosophy for this plant is that it's highly
25 automated. Unlike many existing U.S. plutonium

1 processing facilities, such as in the DOE complex
2 where there is much more hands on operation and
3 gloveboxes really mean gloveboxes with glove portals,
4 this plant doesn't have that look to it. Gloveboxes
5 contain automated systems that are monitored at remote
6 locations by and large.
7 DR. CROFF: And maintenance?
8 MR. BROWN: One of the things that they
9 did describe in Chapter 15 of the CAR is their
10 commitment to management measures. You know, a part
11 of maintaining these principal structure systems and
12 components, which by the way when we receive a license
13 application, that name will change to items relied on
14 for safety, and that's just an artifact of our
15 regulations. We call them something different for
16 construction, but they're essentially the same thing
17 in the license application. They're just called items
18 relied on for safety.
19 One of the management measures that would
20 be appropriate for items relied on for safety is
21 maintenance and surveillance, and DCS will provide
22 most of that detail later with the license
23 application.
24 DR. CROFF: I understand that. I do
25 remember Chapter 15 in reading through that, and it

1 was pretty -- well, it was pretty terse, to be
2 charitable, in terms of the maintenance philosophy,
3 basically saying, "We're going to have a maintenance
4 plan."
5 But my point is ALARA and the routine
6 occupational doses received during operation and
7 maintenance is a function of how the plant is
8 designed, how cells are laid out, whether they have to
9 enter them, the extent of clean-out, and can they
10 clean them out, and worrying about that later when the
11 die is cast on construction on the plant design,
12 you've sort of got to do what you've got to do when
13 the plant is built.
14 And I'm just not seeing that as a
15 consideration. It's focused on safety, which means
16 accidents for the most part, not routine operation and
17 ALARA. Maybe it's an artifact of this two step thing,
18 but they're going to be a long ways down the road
19 before they worry about it.
20 MR. BROWN: Well, they're certainly
21 considering that in design, and there are commitments
22 to ALARA design methodologies, and they're described
23 in the CAR, but you kind of hit on it. It's not
24 effective, the two-step process. What we're focused
25 on now are accidents and the effects of natural

1 phenomena hazards on the facility.

2 DR. CROFF: It seems that the focus maybe

3 needs to be on considering everything that's a concern

4 when the die is cast on the construction and design.

5 I understand that opinion.

6 DR. RYAN: Just a follow-up question on

7 waste management. As I understand reading through

8 everything, the hand-off is DOE will manage the waste

9 produced by the facility. It seems like that's sort

10 of a curtail to me. How do you know that they're

11 going to be capable and robust and keep the waste

12 moving so that it doesn't choke out the plant or cause

13 a back-up or cause interruption of service? That's

14 one.

15 And the second is in licensing the

16 facility, how do you assure yourself that the waste

17 management plan is going to work and that they've done

18 other things that won't have a backward impact on the

19 facility itself.

20 MR. BROWN: Well, at this point the waste

21 management systems in the plant have to be considered

22 as part of this safety review for the effects of

23 potential accidents and natural phenomena, but the

24 regulations allow for transfer of custody of that

25 waste from our licensee back to DOE, at which point it

1 does become DOE's responsibility.

2 I understand your question. There could

3 be problems which could affect, you know, future

4 operation of the plant, but unless I can tie that to

5 safety at the plant, we didn't raise that as an issue

6 now.

7 DR. RYAN: And maybe I didn't bore into

8 the details enough to understand this, but it wasn't

9 clear to me that the facility, that which the NRC is

10 going to license, is going to process all of the waste

11 to come endpoint ready for disposal.

12 MR. BROWN: Okay.

13 DR. RYAN: I understand that they're not.

14 MR. BROWN: They're not going to process

15 all of the waste suitable for the endpoint.

16 DR. RYAN: There seemed to be a mix that

17 they were going to take care of some things, but

18 perhaps not others.

19 MR. BROWN: Right.

20 DR. RYAN: And it's those wastes that are

21 going to be sent out for processing and preparation to

22 DOE that just put the question in my mind: well, what

23 if that doesn't work right?

24 And that's certainly something that --

25 DR. RYAN: I mean, is that going to say,

1 "Okay, you can't produce anymore waste now. We're not
2 ready to receive it"?
3 It seems to me that hand-off isn't as
4 clear as it needs to be for the NRC to feel
5 comfortable in taking an action to move forward.
6 MR. BROWN: Well, at this point, the best
7 description of all of that sort of the waste disposal
8 because actually in our draft EIS, which is assumed to
9 be final, where we look at the waste management
10 impacts, because under NEPA, you know, we did take
11 that broader view and looked at were there going to be
12 unacceptable or high impacts of adding this waste to
13 the existing Savannah River site waste management
14 program.
15 DR. RYAN: But not in any detailed
16 quantitative way. I mean you haven't revised SRS'
17 area dose assessments or any of that sort of thing.
18 MR. BROWN: No, not us.
19 DR. RYAN: The devil is in the details on
20 all of that.
21 MR. BROWN: We did it in a way to insure
22 ourselves that there was sufficient waste management
23 capacity at Savannah River site.
24 Something you may recall is initially when
25 we received this application, the plan was to send the

1 high alpha activity waste, the highest radioactivity
2 liquid waste, to the Savannah River site tank farms,
3 which were already nearing capacity at that point,
4 which is why, partly why, they now have this new
5 concept which is the waste solidification building
6 which will treat that waste and not send that waste to
7 the tank farms.
8 So DOE is certainly well aware of the
9 issues they have to deal with, as we are.
10 DR. RYAN: And I understand that, and you
11 know, they are complicated, and there's more than one.
12 But the question still remains in my mind and maybe
13 the information is out there to answer it, but how
14 confident are we that there isn't a choke point that
15 will cause the "don't produce anymore waste" light to
16 go on?
17 And, again, I'm not saying it's not there.
18 I'm just asking that question. How is that hand-off
19 made?
20 CHAIRMAN POWERS: I'm struggling with, I
21 mean, so what. I mean, you just stop producing,
22 right?
23 DR. RYAN: Well, does that raise any
24 safety issues? Does that raise any --
25 CHAIRMAN POWERS: Yeah, I guess that's

1 what I'm asking. Does it raise any safety issues?

2 DR. RYAN: And I think it has got to be

3 viewed as a system, not just as a bunch of components.

4 CHAIRMAN POWERS: Dr. Weiner.

5 DR. WEINER: I just have a couple, and I

6 recognize that you've discussed the chemical hazards

7 in the document, but I was wondering if there is a

8 parallel matrix to this one for chemical hazards

9 because you're putting your workers at considerably

10 greater chemical risk than at radiological risk.

11 MR. BROWN: Thank you for pointing that

12 out.

13 Yes is the answer. There is an

14 essentially identical matrix with the chemical hazards

15 entered on the left there. then that's the slide I

16 should have used. It would have been clearer.

17 DR. WEINER: The second question is how is

18 this nitrate solution going to be transported into

19 your process. If you're accepting uranyl nitrate

20 solution, where does that come from and how is it

21 transported?

22 MR. BROWN: Well, at this point -- Alex,

23 correct me if I'm wrong -- it will be transported by

24 truck. I don't know who the supplier is at this

25 point. You know, that's not information that we've

1 asked for at this point, but it will be transported to
2 a secured warehouse on the MOX facility site and then
3 from there also transported by truck to the MOX
4 facility.
5 DR. WEINER: I'm concerned about the
6 safety of transporting nitrates. That's the burden of
7 my question.
8 MR. BROWN: Okay.
9 MR. MURRAY: Just to let you know, they
10 would be transported under existing DOT and NRC
11 regulations. I don't think that we went into too
12 great a depth into the specific details, but they
13 would be essentially purchased like an outside
14 reagent.
15 DR. WEINER: So it would be transported
16 under the DOT hazardous materials packaging.
17 MR. MURRAY: Exactly, probably in a Type
18 A container, yes.
19 DR. WEINER: Yes. I would imagine Type A
20 container, but they have special ones for nitrate.
21 And then this is just a question, and I
22 suppose it should be directed at DOE, not you. There
23 is a pit disassembly facility in operation today at
24 Pantex. Is it out of the question to have the
25 disassembled pits transported?

1 I mean, we do have experience transporting
2 pits and disassembled pits. Why are we spending
3 zillions of dollars to build a pit disassembly
4 facility when one exists?
5 MR. BROWN: And I can't answer that
6 question.
7 CHAIRMAN POWERS: It does seem somewhat
8 out of our jurisdiction.
9 DR. WEINER: Yeah, I'm sure it is. I said
10 it was probably a question for DOE, not for you. But
11 there isn't -- well, it is out of our jurisdiction.
12 CHAIRMAN POWERS: Mr. Rosen.
13 MR. ROSEN: Yes, Dana. In the document I
14 was looking at presumption or philosophy that's given
15 here. You're dealing with two very serious risks.
16 One is the risk of nuclear criticality safety, and the
17 other one is a risk of fire.
18 And in the document there's a paragraph.
19 I forget exactly where it is, probably in the NCS
20 section, that says if we have a problem where we're
21 comparing those risks, we're going to make sure that
22 the nuclear criticality safety doesn't occur, and that
23 is embodied by the fact that, you know, you end up
24 with not using water to prevent moderation excursions,
25 excessive moderation excursions.

1 And so there are cases where you're going
2 to have to make a choice and use these clean agent
3 suppression systems to put first out where you don't
4 want to use water. On the surface of it, if you don't
5 think about it too much, I think you come to that
6 conclusion very easily. You want to have it.
7 In one case I guess you're protecting the
8 workers, in the case of nuclear criticality safety.
9 In the other case, you'd mainly be protecting the
10 public, that is, from a fire, the effects of a fire.
11 And it isn't obvious to me just from
12 reading what I've read that that choice is a simple
13 one. Maybe that's too complex a question for this,
14 and yet at some point I would feel it needs to be
15 addressed, some sort of analysis provided for when you
16 decide clearly not to suppress a fire by the most
17 effective means, which is water.
18 MR. BROWN: I don't know exactly where
19 that statement is. I hope it doesn't convey the point
20 that, you know, we need to worry about crit. safety.
21 Therefore, we're going to have to let the fire happen.
22 You know, both risks have to be reduced to acceptable
23 levels, but you know, what was probably intended there
24 was that we need to make sure when we're righting the
25 fire we're not causing another event.

1 And so they'll have to show that that
2 clean agent system adequately reduced the risk.
3 MR. ROSEN: Well, you know, clean agent
4 systems may be good at suppressing a fire, but they
5 don't take much heat out, and when oxygen gets back
6 into a compartment where you've suppressed it with a
7 clean agent fire, it's likely to flash. And that's
8 the concern.
9 MR. BROWN: Okay.
10 CHAIRMAN POWERS: Dave, just a point of
11 clarification. It seemed to me with the new site
12 boundary that a recreated accident assumed much
13 greater consequences than it did when we had the
14 longer four mile boundary.
15 I think I saw 900 millirem at the site
16 boundary as the bounding recreate accident dose.
17 MR. BROWN: Okay. Yeah, since that
18 accident is mostly dosed from the least noble gases in
19 volatile fission products, sure, it would have gone up
20 by the proportion of how the atmospheric dispersion
21 is, now less at that point.
22 CHAIRMAN POWERS: I mean, you go from
23 having basically an alpha hazard with your fire to now
24 having a gamma hazard.
25 MR. BROWN: Yeah, that is considered as

1 part of the hazard safety assessment, sure.

2 CHAIRMAN POWERS: That's a significant

3 change.

4 MR. BROWN: Yeah.

5 CHAIRMAN POWERS: You go from having an

6 inhalation toxicology to having an exposure kind.

7 MR. ROSEN: I'm interested in this area,

8 and anything you can do to help me through the

9 difficulties I have with this would be helpful.

10 MR. BROWN: Okay. Yeah, I do want to go

11 back and take a look at -- and I'll talk to our expert

12 about --

13 DR. FORD: This seems to be a fairly

14 fundamental question though. I would have thought it

15 would be answered, the question about using water to

16 put out fires and thereby the possibility of

17 moderating the --

18 MR. BROWN: Yeah, what I'd like to go back

19 and check, the feature most relied on for fire safety

20 are the fire barriers, passive barriers to the spread

21 of the fire, and then for areas where there's

22 disbursable material there's also the clean agent

23 suppression system.

24 What I would like to maybe examine a

25 little bit more is this question of, well, yes, the

1 clean agent system is not as effective as water in
2 removing heat. Is that still okay? Because I have a
3 two-hour fire barrier there or three hour fire barrier
4 there that can withstand the full heat of the fire.
5 MR. ROSEN: Yeah, and I think I agree with
6 you that it can withstand the fire effects and prevent
7 the spread of a fire, but you still have the fire in
8 that area, and it needs to ultimately cool that area.
9 And that's where you end up with this, I think,
10 discussion.
11 MR. GIITTER: I just wanted to remind you,
12 too, that the integration of those two issues,
13 criticality safety and fire protection, is going to
14 happen in greater detail as part of the ISA process.
15 So, you know, that's something that the applicant will
16 have to address in their license application. We will
17 be looking much closer at later on.
18 MR. TROSKOSKI: And that process will also
19 consider the past operating events that we have had,
20 including -- I'm sorry. Bill Troskoski. I'm one of
21 the chem. safety reviewers.
22 The ISA process in addition will also
23 consider the operating events that have occurred in
24 the industry and the lessons learned from those,
25 including the fires at Rocky Flats.

1 CHAIRMAN POWERS: I don't want to rely
2 totally on the future to resolve this question. I
3 think I need to understand it philosophically here,
4 not necessarily in quantitative detail, but
5 philosophical approach. I mean now you look at this
6 particular kind of accident because this was one we
7 raised what, a year and a half ago or something like
8 that?
9 MR. MURRAY: And just to let you know,
10 Chris Tripp, the criticality safety reviewer, will be
11 discussing criticality safety tomorrow morning.
12 MR. BROWN: That would be a good time to
13 bring that up again.
14 MR. ROSEN: Well, I'm more interested in
15 the fire safety.
16 MR. BROWN: Okay.
17 MR. ROSEN: It ends up being a fire safety
18 issue.
19 MR. BROWN: That's right.
20 MR. ROSEN: So Mr. Wescott --
21 MR. BROWN: He will be here this
22 afternoon.
23 MR. ROSEN: And I need to talk to him.
24 MR. MURRAY: Yes, Rex will be here this
25 afternoon.

1 CHAIRMAN POWERS: And just for the
2 members' information, I have asked that Dr. Diamond at
3 the DNL look at the criticality portions of this, both
4 the SER and the CAR, and he'll provide us a report
5 prior to our February meeting.
6 MR. BROWN: Well, thank you.
7 CHAIRMAN POWERS: Vic.
8 DR. RANSOM: In terms of the safety
9 aspects and design philosophy, are things like this
10 red oil explosion and HAN explosions and even the
11 recriticality considered design basis accidents?
12 MR. BROWN: They are essentially. That
13 vocabulary just isn't in the Part 70 regulations. So
14 that's just not a term we use.
15 DR. RANSOM: I know you spoke in terms of
16 confinements and often our closed reactors have
17 venting systems, and the design of those presumably
18 would hopefully lead to mitigation.
19 MR. BROWN: Yeah. I think what
20 effectively happens is as the applicant goes through
21 and identifies all of the hazards in all of the
22 hundreds of rooms of a plant, it effectively comes out
23 looking like several hundred, if not thousands, of
24 design basis events, all of which have to be
25 considered in their integrated safety analysis.

1 DR. RANSOM: The other one would be what
2 is the history of these kinds of systems. I mean, the
3 French have built them.
4 MR. BROWN: Right.
5 DR. BONACA: And maybe others, too, and
6 I'm wondering is this facility going to be similar or
7 based on a lot of that history.
8 MR. BROWN: This facility, as the name of
9 the future licensee implies, is Duke Cogema Stone &
10 Webster, and Cogema is a significant partner in this
11 enterprise, and is using their experience at the La
12 Hague reprocessing plant and the systems installed
13 there for the design of the aqueous polishing step in
14 the U.S. MOX plant and is also using their experience
15 at the MELOX mixed oxide fuel plant in the south of
16 France, which has now been operating, I think, nine
17 years and many of those systems are components in the
18 U.S. MOX fuel plant.
19 There is a step where those designs are
20 Americanized, if you will, to comply with U.S. codes
21 and standards. So there will be subtle changes
22 associated with code compliance in the U.S.
23 DR. WALLIS: And change all of the
24 dimensions to feet and inches?
25 (Laughter.)

1 CHAIRMAN POWERS: I will just remind those
2 of you that are new to this that several members were
3 able to visit La Hague and MELOX, and I think they
4 came away reasonably impressed with the sophistication
5 of the operation. Certainly it's a much more modern
6 facility than those in the United States that I'm more
7 familiar with.
8 MR. MURRAY: Yes. I will just add one
9 comment on this question. As part of the staff's
10 review, we have looked at historical events at DOE
11 and/or other facilities, and also what is currently
12 good practice in the industry. Sometimes the jargon
13 "RAGAGEP" reasonably and generally accepted good
14 engineering practice is used, and we have looked at
15 that to get to some measure of the evaluation of the
16 proposed controls for specific events and hazards.
17 MR. BROWN: If there are no other
18 questions, I'll have Alex begin his first
19 presentation.
20 Let me see if I can help you get that
21 started.
22 MR. MURRAY: Good morning, everybody.
23 Thank you so much for inviting the NRC team here to
24 inform you and make presentations for today.
25 For the two people in the room who don't

1 know me, my name is Alex Murray. I am the lead
2 chemical safety reviewer for the MOX program, and I'm
3 in the NMSS office.
4 Now, I want to give some discussion about
5 the closure of open items which we had in the revised
6 safety evaluation report or RDSER and also some of
7 these open items were discussed at the November 2003
8 ACRS meeting.
9 I have listed the specific open items
10 which we will go through today. Myself, Bill
11 Troskoski and Rex Wescott will be splitting the
12 presentation between us. The open items are as shown
13 and include a number of potentially high consequence
14 events which the applicant has elected to essentially
15 prevent or has identified a preventative strategy for
16 them.
17 And then at the end of the presentation,
18 myself and Dave, we will provide brief summary.
19 Now, the first specific open item we're
20 going to discuss is CS-01, which is termed "red oil."
21 In the proposed process, there's an aqueous polishing,
22 which is really a single cycle Phrex solvent
23 extraction step for purifying the plutonium and
24 separating it from impurities. Those impurities
25 include americium, gallium, and uranium.

1 Because this is a solvent extraction
2 process, you have two phases. You have an aqueous
3 phase, which is essentially concentrated nitric acid
4 up to about 13.6 molar.
5 You also have an organic phase, and this
6 is essentially the standard Purex extractant mixture,
7 which is tributyl phosphate in a branched dodecane
8 mixture.
9 CHAIRMAN POWERS: Alex, can I ask you a
10 question?
11 MR. MURRAY: Sure.
12 CHAIRMAN POWERS: In the document, you
13 used the term "hydrogenated propylene tetramer."
14 MR. MURRAY: Yes, that's branched
15 dodecane.
16 CHAIRMAN POWERS: And how you use branched
17 dodecane. The organic chemistry profession has gone
18 to heroic limits to standardize its nomenclature.
19 What are these things?
20 MR. MURRAY: Well, it turns out that the
21 main, if you will, component of constituent of the
22 diluent is a branched dodecane, and essentially it is
23 made, if you will, from joining propylene molecules
24 together. Okay?
25 However, it is also distilled when it is

1 manufactured. So you do get some other species in
2 there as well. So you essentially have what in the
3 chemical process industry is called a boiling point
4 curve for the mixture.
5 MR. ROSEN: Do you have a chemical symbol
6 for this thing? Could you draw it for me? I mean not
7 today, but I mean --
8 (Laughter.)
9 MR. ROSEN: I mean, let's go back to
10 fundamentals.
11 CHAIRMAN POWERS: I think what Alex is
12 saying is it's a mess. You get a bunch of branched
13 dodecanes and they don't want to specify it out. I
14 mean --
15 MR. MURRAY: It's a commercial product.
16 CHAIRMAN POWERS: -- in the DOE
17 literature, it's called normal paraffinic hydrocarbon,
18 and it's still a branched dodecane, but I mean, I'm
19 just surprised that there's so much diversity of
20 nomenclature both in the SER and the CAR and the
21 viewgraphs. They're all different.
22 I mean, it doesn't matter. I mean, the
23 point is you've got a bunch of organic that can burn.
24 MR. ROSEN: It doesn't matter, but my
25 chemical engineering sensibilities are offended by the

1 idea that I don't really know what I'm dealing with.
2 And so during the break perhaps, Alex, you could take
3 a piece of paper and draw something and say this is --
4 MR. MURRAY: Sure.
5 MR. ROSEN: -- it's mostly this stuff.
6 MR. SIEBER: You can draw anything. He
7 won't know.
8 CHAIRMAN POWERS: It's kerosene, yep. The
9 hydrogenated --
10 MR. MURRAY: I'll draw it properly.
11 CHAIRMAN POWERS: -- hydrogolene propylene
12 tetramer, which is a new one to me.
13 DR. WEINER: Yes.
14 MR. MURRAY: Yes, but it is a branched
15 dodecane. It is comparable to the normal paraffinic
16 dodecane which has been used in U.S. facilities. That
17 is more of an exact straight chain with little
18 branching.
19 Now, red oil refers to the formation of
20 nitrated organic compounds in this mixture. Okay?
21 So red oil is really a collective term. Okay. It's
22 not a precise term. It can refer to the mixture
23 containing butyl nitrate. It can refer to a nitrated
24 tetrapropylene hydrogenated dodecane. So we just use
25 the collective term "red oil."

1 CHAIRMAN POWERS: Which is neither an oil,
2 nor is it necessarily red.
3 MR. ROSEN: Although sometimes it is.
4 (Laughter.)
5 MR. MURRAY: What I've shown on this
6 slide, I like to try and bring in some illustrations.
7 A picture is worth 1,000 word. Okay. This is from
8 some tests which were conducted in I guess it was more
9 like the mid-1990s for people by contractors in the
10 Department of Energy complex on the -- if I don't zap
11 myself here with the laser -- on the far left, this is
12 the normal organic solvent with tributyl phosphate in
13 a dodecane mixture.
14 As you go from left to right over here you
15 have where the mixture has been exposed for more time
16 and/or more temperature to nitric acid, and as you can
17 see, it generally starts getting a little darker, and
18 as you go into high temperatures, high temperatures
19 meaning reflux type conditions, 110 to 120, even 130
20 Centigrade, you get more rapid reaction and more of a
21 reddish hue.
22 And the sample on the far right was from
23 a test where it actually underwent if you will the
24 decomposition reaction.
25 CHAIRMAN POWERS: These were from the

1 tests that were done up at LANL?

2 MR. MURRAY: Los Alamos, yes.

3 DR. WALLIS: Besides color, do you have a

4 description of the kinetics of these reactions that

5 you can estimate how rapidly they will occur?

6 MR. MURRAY: There are some kinetic

7 equations out there. As part of the staff review, we

8 have looked at some of the presented equations and

9 converted these to temperature rises, potential

10 temperature rises on --

11 DR. WALLIS: Yeah, particularly on the

12 right-hand end when you have potential for

13 uncontrolled reaction.

14 MR. MURRAY: Yes.

15 DR. WALLIS: It would seem that there must

16 be criteria for whether or not you can control and how

17 much margin you need to have and all of this sort of

18 stuff.

19 MR. MURRAY: We will get into that as we

20 go more into this presentation.

21 DR. FORD: When you say there's some

22 kinetic data, is there enough kinetic data so you can

23 control this adequately?

24 MR. MURRAY: I would say the majority of

25 the information for controlling red oil species and

1 red oil reactions is based on empirical operational
2 experience and empirical laboratory testing. I would
3 say for the most part, fundamental analysis using
4 kinetic rate equations, continuous attack ester tank
5 reactor mechanics, for example, to a large degree has
6 not been done, historically for defining operational
7 limits or in the construction permit application.
8 DR. FORD: The way you described it, you
9 gave the impression at least that it was almost an
10 autocatalytic effect, i.e., took off in a rush.
11 MR. MURRAY: It can be thermal runaway
12 reaction.
13 DR. FORD: And, therefore, is there enough
14 time to control this before --
15 MR. MURRAY: As we get more into the
16 controls and the proposed strategy in our evaluation,
17 I'll try and answer that, but I think it's very
18 important to remember the applicant has identified a
19 preventative strategy. Okay? So the applicant does
20 not want the event to occur. So you don't want to get
21 into, if you will, waiting for seconds to tick down on
22 the clock.
23 CHAIRMAN POWERS: When people look for
24 detailed understanding on this, the difficulty, I
25 think it's my impression that the fundamental

1 difficulty with red oil is that we have never been
2 able to persuade ourselves that what gets created in
3 the laboratory is, in fact, what caused the event.
4 And of course, the difficulty is the event
5 is only detected after you've blown up your facility,
6 and so it's hard to find what actually did the blowing
7 up. And so you've never persuaded yourself that this
8 red stuff is, in fact, whatever caused the event.
9 DR. WALLIS: Well, this makes it difficult
10 to scale up and all that kind of thing if you don't
11 have some sort of equations or --
12 CHAIRMAN POWERS: No, it doesn't, Graham.
13 DR. WALLIS: It doesn't?
14 CHAIRMAN POWERS: This is where I think
15 just what Alex said. It is like most chemical
16 processes in this world. Most industrial chemical
17 processes are not based on equations. They're based
18 on when I do it this way, I get the right stuff. If
19 I do it any different way I blow up my facility, and
20 that is true of, I would dare say, 95 percent of the
21 chemical processes run worldwide.
22 Is that a fair --
23 MR. MURRAY: I would say it's a very large
24 percentage. I'm not sure exactly 95 percent, but it's
25 getting there.

1 CHAIRMAN POWERS: It's awfully close to
2 that.
3 DR. WALLIS: So it's the same as we read
4 about on page 602 of our criticality safety where it's
5 said to be based on skill of the craft and said to
6 require intuitive understanding of neutron physics.
7 That seems to me --
8 (Laughter.)
9 DR. WALLIS: -- pretty hopeful. I mean,
10 I would like to have more than an intuitive
11 understanding of neutron physics in order to
12 understand criticality.
13 MR. MURRAY: Well, as we get more into
14 this discussion, I think that what is presented will
15 help.
16 DR. WALLIS: So you are going to reassure
17 us, are you?
18 MR. MURRAY: Well, perhaps when we get to
19 the end you'll be assured.
20 DR. WALLIS: Or are you going to convince
21 us?
22 DR. RANSOM: Are these vapor phase or
23 liquid phase on interphasial reactions?
24 MR. MURRAY: They are liquid phase
25 reactions primarily, and I want to emphasize

1 "primarily." They tend to occur more violently around
2 the interface between the organic phase and the
3 aqueous phase, okay, and normally with a few
4 exceptions, in all of these processes the organic
5 phase is lighter and is on the top.
6 DR. WALLIS: So mixing comes into it, does
7 it?
8 MR. MURRAY: Mixing can come into it, yes.
9 DR. WALLIS: Do you think it's stirred up
10 by its own reaction?
11 MR. MURRAY: Yes. Now, one thing to keep
12 in mind. Gaseous phase reactions can contribute to
13 the brisance, the explosiveness, of the event if those
14 gaseous phase products are not removed. These species
15 can include butyl alcohol, butyl nitrate, some others,
16 sometimes butane. Okay? So they can be quite
17 flammable in case your species evolve, and if they are
18 confined within the vessel, they contribute to the
19 event.
20 DR. FORD: Just in terms of the process,
21 the discussion process, it's my understanding right
22 now all you're doing is identifying an issue and how
23 qualitatively you're going to control it. The
24 specifics of how you're going to control it, whether
25 you approve of the Cogema's strategy for managing this

1 issue, that doesn't come until some time next year,
2 and that's when we will be asked to make comments
3 about the adequacy of that control?
4 MR. MURRAY: For most of the open items
5 which we are discussing today, there are some specific
6 control parameters identified. All right? Now, as
7 regards to what will happen with the license
8 application, we expect that the identify principal
9 structure systems and components will be fleshed out
10 in more detail from a systems level to more of a
11 component level: how many thermocouples or RGDs do
12 you have monitoring the process? Where are they
13 located? Are they adequate to give an accurate
14 temperature measurement and so forth?
15 DR. FORD: That will come later.
16 MR. MURRAY: That will be later, but we
17 have some specific parameters identified already.
18 Also, with this being the construction
19 authorization phase, we are not looking at set points.
20 We have looked at the set point methodology, which is
21 part of the design basis.
22 Well, let me move on. Just to get some
23 feel, I'm a chemist, chemical engineer, and -- I'm
24 sorry. Is there a question?
25 DR. BONACA: No, no. I said, "There you

1 go," meaning you were asking about some.

2 MR. MURRAY: This is just a sample, a

3 diagram which shows sample reaction pathways, and I'll

4 just point out to you tributyl phosphate is the actual

5 extractant in the diluent mixture. It can go under

6 various reactions to form DBP and MBP, which are

7 dibutyl and monobutyl phosphate esters, respectively.

8 All right. These compounds all over here

9 can react further in the presence of heat and nitric

10 acid and radiation to go to the C4 species, even to

11 some of the C3 species. Okay?

12 In the end, if you have a red oil event,

13 you're essentially taking the organic and converting

14 it to a mixture of the gases, all right, nitrogen, CO,

15 CO_2, some of the nitrogen oxides.

16 DR. WALLIS: This is exothermic?

17 MR. MURRAY: And it is exothermic, yes.

18 So you have both the energy release, which heats up

19 the mixture, and you also have the evolution of

20 significant quantities of gaseous species, which also

21 contributes to, if you will, the event.

22 And I will say there are some other

23 reactions beyond these, but this is a pretty good

24 summary.

25 MR. ROSEN: This is another one of those

1 slides I'd like to have that I can't quite see.

2 MR. MURRAY: The reaction pathway one?

3 DR. WALLIS: It's not just exothermic. It

4 makes a lot of gases.

5 MR. MURRAY: Right.

6 DR. WALLIS: So there's going to be a

7 pressurized --

8 MR. MURRAY: Exactly, exactly. You get a

9 double whammy, if you will.

10 Okay. Let's see. This is a little hard

11 to read in the handout. So I just wanted to identify

12 generically in the process where this is a potential

13 concern, where potential red oil events can occur.

14 They are primarily in areas where you have the solvent

15 and the solvent extraction processes.

16 However, one thing from operating plant

17 experience is the solvent can move around and

18 accumulate in other areas, such as what is termed in

19 this facility the oxalic mother liquor recovery area,

20 into the precipitation steps, even to acid recovery

21 and waste.

22 And on this slide I have summarized the

23 safety issue, and what I want to point out is these

24 species -- it turned out pretty well. That is

25 actually from the American Institute of Chemical

1 Engineers on overheated reactor.

2 These red oil species can undergo

3 exothermic reactions, and they can do it with

4 relatively small quantities. Estimates for some of

5 the advance up in quantities, well under 100 gallons.

6 One of them it is postulated might have been around 50

7 gallons.

8 Okay. These are --

9 DR. WALLIS: And the more you have, the

10 worse it is then.

11 MR. MURRAY: Yes, yes. That's correct,

12 but --

13 DR. WALLIS: Why does quantity come into

14 it? I mean, if it's an exothermic reaction and the

15 right conditions, it's going to happen.

16 MR. MURRAY: This is the amount that

17 participates in the event. All right? It's not, if

18 you will -- if you have more quantity of material,

19 you can have more exothermicity, more of a pressure

20 rise and, if you will, more of an explosion.

21 However, the significant thing for our

22 purposes here is that the quantities which are formed

23 and reacted in historical incidents and events are

24 comparable to quantities at their proposed facility or

25 quantities which could form at the proposed

1 facilities.

2 MR. ROSEN: But Graham's point is still of

3 interest to me. If you just had a little cup of this

4 stuff someplace, it would experience a reaction.

5 MR. MURRAY: Yes.

6 MR. ROSEN: It might not be important,

7 but --

8 MR. MURRAY: Right. And if you have 1,500

9 gallons of the material, you can blow out four foot

10 thick shield plugs and do quite a bit of damage.

11 DR. WALLIS: If you were doing research,

12 you might do it with a small quantity.

13 MR. MURRAY: Exactly.

14 (Laughter.)

15 MR. MURRAY: Preferably a very small

16 quantity.

17 CHAIRMAN POWERS: I believe that in the

18 solvent recovery facility in Purex, they came to the

19 conclusion they were probably getting the events on

20 time.

21 MR. MURRAY: Yes.

22 CHAIRMAN POWERS: And it was only when

23 they shut down for a clean-out of a facility

24 accumulated a lot of it and then started up that they

25 got an event that anybody knew was actually

1 happening.

2 MR. MURRAY: Yes. I should just clarify

3 the point. In Purex time systems, red oil reactions

4 happen all the time, except they happen at a slow

5 rate, and the relative concentrations of the degraded

6 products and other species are relatively small.

7 It's a classic kinetic type of

8 consideration: higher concentrations, higher

9 temperatures, higher nitric acid concentrations.

10 Ultimately those can, if you will, increase the

11 kinetic rates to a point where they become a concern.

12 MR. ROSEN: And in the process of getting

13 to the garden variety end products you end up with,

14 which no one would be concerned about: nitrogen,

15 carbon dioxide, et cetera.

16 MR. MURRAY: Exactly, exactly.

17 MR. ROSEN: And you have all of the fun.

18 MR. MURRAY: Yes.

19 MR. ROSEN: The end products don't matter

20 much to you is what gets you there.

21 MR. MURRAY: It is what gets you there,

22 and if those end gaseous species cannot escape.

23 CHAIRMAN POWERS: And, Mr. Croff, this is

24 an area that you might be particularly interested in

25 because I think you can track every single major event

1 to some change in operations, either stopping them,
2 starting them, a different way of doing things than
3 coming back.
4 So operations does seem to affect this
5 process.
6 DR. FORD: So many of those instances have
7 had a human factor route to them?
8 MR. MURRAY: I don't know if I would say
9 exactly a human factor route, but they have tended to
10 involve unnoticed accumulation of organic material in
11 a tank vessel or evaporator, and often that involves,
12 if you will, human monitoring by chemical sampling
13 analysis, sometimes as simple as looking at the two
14 phases showing on the site glass or on the remote TV
15 camera, what have you.
16 Okay. Just in simple terms, if you remove
17 aqueous phase from a solvent extraction system, say
18 it's at 60 degrees Centigrade, okay, a not uncommon
19 temperature, and you put it into a vessel, again, just
20 the aqueous phase, as that aqueous phase cools down,
21 organic materials that have dissolved in that aqueous
22 phase become less soluble. So they tend to separate
23 out and coalesce as a separate organic layer on top of
24 the aqueous phase in that tank or vessel.
25 And in many of the Purex type facilities

1 around the world, it is that type of phenomena which
2 has contributed to these events.
3 CHAIRMAN POWERS: I think that everyone
4 that I can bring to mind something got changed.
5 MR. MURRAY: Yes.
6 CHAIRMAN POWERS: Some disruption.
7 Weekends seem to be particular --
8 MR. MURRAY: And shift changes, yes, yes.
9 DR. WALLIS: Can you control this
10 reaction? It seems to be what they're going to do.
11 There's no defense in depth, and if it does run away,
12 it gets vented into something where you can keep it
13 under wraps. It's vented in some way?
14 MR. MURRAY: Well, ultimately this is a
15 reaction which occurs within vessels, piping,
16 evaporators, all of those, if you will, vent either
17 through the off gas treatment system or there's a
18 vessel vent system as well.
19 DR. WALLIS: So if the reaction got out of
20 control, stuff would come pouring out the vent. Is
21 that what would happen?
22 MR. MURRAY: And that is one of the
23 reasons why the applicant has selected a preventative
24 strategy, yes.
25 MR. ROSEN: And that stuff pouring out the

1 vent is hot and being blasted, and it's likely to be
2 a fire, ignition source; am I correct?
3 MR. MURRAY: It could be.
4 MR. SIEBER: Could.
5 MR. MURRAY: It could be, yes. It is
6 likely to be hot.
7 DR. FORD: But the preventative action is
8 primarily engineering monitoring systems, i.e., remove
9 all human dependencies.
10 MR. MURRAY: It's a combination of what I
11 would call engineered controls and administrative
12 controls.
13 MR. MURRAY: And do we know of the
14 reliability of those engineered controls? Is there a
15 database from the chemical industry, for instance?
16 MR. MURRAY: The staff as part of its
17 review and analysis, we have looked at some of the
18 ranges of reliability for some of the proposed
19 controls and have made some conclusions regarding
20 those controls.
21 DR. FORD: And will that in much more
22 detail come into the part that's going to be done next
23 year?
24 MR. MURRAY: Yes, it will have to come
25 into more detail and be integrated safety analysis,

1 which will be -- the summary of which would come in
2 with the license application.
3 And here I'm discussing the applicant's
4 safety approach. First off, the applicant has
5 identified this as a high consequence event, and they
6 have selected a preventative strategy to render the
7 event highly unlikely, in effect, stop the event from
8 occurring.
9 All right, and I want to point out that
10 when we received the initial application, which is
11 almost four years ago now, at that time there was only
12 one PSSC or control identified with one safety
13 function.
14 In the revised application, which we
15 received this past June, there have been additional
16 PSSCs added and additional safety functions
17 identified, and also there's a commitment to further
18 research and experiments to understand the phenomenon
19 better.
20 DR. FORD: Now, when you say it's a
21 preventive strategy, vent highly unlikely, you
22 mentioned earlier on that was about a frequency of ten
23 to the minus four per plant year. Was there any PRA
24 done to justify that conclusion that you have gotten
25 there?

1 MR. MURRAY: We did not do PRAs. We have
2 used some top level fault tree types of analyses. We
3 have used some of the guidance from the appendix in
4 the MOX standard review plan to get some, if you will,
5 gauge of how responsive, how reliable some of these
6 proposed controlled strategies, these PSSCs and safety
7 functions can be.
8 DR. FORD: Well, a more PRA-type exercise
9 be done next year?
10 MR. MURRAY: That is entirely up to the
11 applicant. The applicant has the option of doing this
12 in a qualitative mode similar to what they've done
13 now. They can do it in a semi-quantitative mode or
14 they can do it in a quantitative mode. I think we'd
15 have to wait until next year.
16 DR. FORD: Is there some reason why we're
17 not insisting that they use a PRA?
18 MR. GIITTER: The regulation --
19 CHAIRMAN POWERS: Peter, you need to look
20 at the regulation. What Alex described is called an
21 integrated safety analysis. This is not PRA land, and
22 so if you contest that, you contest a battle that
23 we've already been through at some length, and the
24 Commission has made a decision. Okay? So they are
25 the people you should interrogate, I think.

1 DR. FORD: I recognize there's two worlds
2 we live in here. There's the world that was
3 formulated when the regulations were written versus
4 what is technically state of the art.
5 CHAIRMAN POWERS: Well, now, hold it.
6 Integrated safety assessment is recognized as the
7 state of the art within the chemical community. You
8 sit next to a guy that's got PRA on the brain usually.
9 There are other people who have to deal with safety
10 and have found effective ways of doing it.
11 DR. FORD: Yeah, I know, and I accept
12 that. It's just that sprinkled in here we have talked
13 about what was the definition of highly unlikely
14 before, and we got one out of here, and thank you.
15 MR. MURRAY: You're welcome.
16 DR. FORD: But I'm trying to delve down to
17 find out how much quantitative knowledge --
18 MR. ROSEN: I applaud your question line,
19 Peter, but you're almost to the bottom of what they're
20 willing to do in terms of heading in that direction,
21 and Lord knows for me I would certainly encourage
22 more, but that's what the regulations embody and rely
23 on and require, is what you're hearing.
24 DR. FORD: Okay.
25 MR. GIITTER: I would just add that Part

1 70 is performance based and risk informed regulation.
2 It was recently promulgated in 2000. So as Dr. Powers
3 indicated, it is state of the art in terms of looking
4 at risk for fuel cycle facilities. They are different
5 beasts than reactors. I want to remind you of that,
6 although in terms of complexity, the MOX facility
7 certainly is probably the most complex fuel cycle
8 facility that we're currently looking at from a safety
9 perspective.
10 DR. FORD: I guess I'm kicking against the
11 system here just to see how much it will give. If
12 this thing blew up, heaven forbid, we would be
13 crucified if we didn't kind of come up with that you
14 didn't apply knowledge from, for instance, other
15 industries, et cetera, to this chemical plant. I'm
16 kicking at that.
17 CHAIRMAN POWERS: I think you're taking an
18 inferior position. There has been over the last 25
19 years a huge, enormous effort that makes the PRA
20 effort pale in comparison as far as number of dollars
21 spent on developing strategies for handling, assessing
22 the safety of operations in chemical processes.
23 In fact, the American Institute of
24 Chemical Engineers maintains a center on exactly this.
25 I think Alex is more familiar with it than I am.

1 MR. MURRAY: Yes.

2 CHAIRMAN POWERS: There are shelves of
3 books on how to do this sort of thing. Now, that
4 particular community has struggled with the fact that
5 every single chemical process is different, and that
6 PRA methodologies just don't seem to interface well in
7 that, and they've taken a somewhat different tact.

8 Now, I look at it, and I say, well,
9 they're really only missing a final integration step,
10 and it would look and smell and walk and talk much
11 like a PRA, but it's a reasonably sophisticated field,
12 and, I mean, to say, well, it's not identical to the
13 reactors and, therefore, it's not state of the art is
14 fairly unfair, I think.

15 Some of these, they have a very, very much
16 more sophisticated view on how to handle worker safety
17 than we do in the reactors area.

18 MR. SIEBER: Right.

19 CHAIRMAN POWERS: It's much better, I
20 think. It's a nice societal risk assessment.

21 Well, enough said. Go ahead.

22 MR. MURRAY: Okay.

23 DR. DENNING: Could I interrupt just a
24 bit? But perhaps you would like to first.

25 DR. WEINER: I just had a quick question.

1 How can you really justify classifying this reaction
2 as highly unlikely by putting mitigating efforts on it
3 when it is, in fact, a reaction that has occurred
4 quite frequently over and over again?
5 I mean, if you say that your unlikely
6 range is everything from once in 100 years to once in
7 10,000 or whatever it was, and your highly unlikely
8 range is really a highly unlikely range of ten to the
9 minus four, I would not classify this as highly
10 unlikely.
11 And I'm concerned that that gives a false
12 impression that, yeah, we know what we can do to
13 virtually absolutely prevent this from happening.
14 MR. MURRAY: First off, let me say this is
15 the applicant's proposed safety approach. As we get
16 into the staff's evaluation of it, I think you will
17 see that that is more of a preventative type approach,
18 and we tend to -- we, the staff, who have reviewed
19 this -- tend to agree that the proposed approach has
20 the ability; it hasn't been demonstrated yet, but it
21 has the ability to achieve unlikely likelihoods, if
22 you will, to prevent this event.
23 Okay. In the license application, which
24 we're expecting next year, they have to supply the
25 proof, if you will. The applicant has to give the

1 demonstration by either heuristics, by more detailed
2 analyses be they hazard indices or a layer of
3 protection analysis of some type to give us the
4 confidence, the assurance, if you will, that, yes, not
5 only did you say you have the ability to get to a
6 highly unlikely, if you will, prevention of this
7 potential event, but, yes, you've given us enough
8 information to give assurance that that is, indeed,
9 the case.
10 MR. BROWN: Alex, I'm sorry. If I may
11 interrupt, in your next slide you do talk about open
12 systems. I think it's important to emphasize we're
13 not preventing the red oil reaction. We're preventing
14 an explosion or rupture of vessels resulting from the
15 uncontrolled reaction.
16 MR. MURRAY: Yes, that's a good point.
17 MR. BROWN: I think that's an important
18 point.
19 DR. DENNING: The point that I wanted to
20 make was that I think with regard to the discussion of
21 probabilities, I think the really important issue here
22 is one of we put a lot of emphasis now on the
23 reliability of the PSSC, and if we're not very
24 quantitative about that, and it's very difficult to
25 know is the PSSC really adequate in reducing the

1 frequency adequately of events.

2 And so one of the questions I have for you

3 is when the applicant went here from one PSSC with a

4 single safety function to three PSSCs with different

5 safety functions, is the reason because that they

6 didn't develop enough believe that the one PSSC was

7 adequate to provide the kind of reliability of

8 prevention that we're looking for?

9 How do you really make this judgment of

10 how much credibility we really need for that PSSC,

11 particularly if we mix in administrative controls

12 into that which have a lot of uncertainty associated

13 with it?

14 MR. MURRAY: Well, let me see if I can

15 answer that this way. As part of the staff's review,

16 okay, when we first started this almost four years

17 ago, we noted there was just a single control for this

18 phenomenon. All right. We looked at the presented

19 information from the applicant. We looked at open

20 literature information. We conducted some of our own

21 analyses which are more akin to a layer of protection

22 analysis or a hazard indice sum, if you will, and we

23 concluded that with the information presented at that

24 time, the applicant could not assure us that their

25 proposed safety strategy could prevent this event.

1 Now, as part of the interactions over the
2 past four years between the NRC staff and the
3 applicant staff, the applicant has also reviewed this
4 phenomena in more detail, and they came to the
5 conclusion that more controls were needed, partly
6 based on simple analyses, partly based upon more
7 interactions with DOE facilities and French facilities
8 as to how, if you will, what is the good engineering
9 practice for addressing these types of events.
10 Okay. So it's a combination of many
11 things.
12 DR. BONACA: Well, one observation I
13 wanted to make is regarding the statement we heard
14 here. It is very important, and I think it has
15 confused me from the beginning. I mean, you presented
16 us a MOX regulatory frame work in which you did
17 essentially classified as highly unlikely and likely,
18 and not the initiator, but the actual endpoint, which
19 is the release, okay, the exposure, public dose
20 credited at 25 rems is almost akin to say that for
21 current reactors you're using the criteria of LERF,
22 large early release, and anything that is before that,
23 they call it preventative rather than we don't. It's
24 a mixture of preventative and mitigative.
25 And I think it's important that that point

1 be clarified for us because, you know, then I
2 understand what you're saying there, and this becomes
3 much more credible. It could be a highly unlikely
4 event.
5 MR. ROSEN: Well, I think Mario has made
6 an excellent point. I would want to follow what Rich
7 was saying before about thinking about the reliability
8 of these safety functions, both human and equipment.
9 If you're going to present the safety function and
10 take credit for it, making something highly unlikely,
11 and that function has a hardware component, especially
12 active hardware, something that has to change state,
13 like a valve that has to open or close or something
14 like that.
15 Then I cannot see how I can agree to any
16 kind of number, any kind of functional criteria for it
17 or performance criteria for it unless you tell me
18 something about its quantitative abilities, its --
19 excuse me -- split fraction at the point of whether it
20 opens or closes, something about its reliability.
21 You're forced if you're going to use
22 safety functions of PSSCs and their active components
23 to talk in that language or else it's pretty much
24 meaningless.
25 MR. MURRAY: I just want to say that as

1 part of the staff's review, we did look at, if you
2 will, ranges of reliability for some of the proposed
3 safety strategies. Again, as part of a construction
4 organization review, we'll looking for approaches that
5 have the ability to meet the regulations and the
6 license application. The applicant has to provide the
7 proof, if you will, the demonstration.
8 MR. ROSEN: Right, and I understand that
9 when you come back the second time to the ACRS you'll
10 have all of that looked at, and you'll be able to tell
11 us. If we put our hand on a valve on a drawing
12 someplace and ask you, "Is this important, Alex?" and
13 you say, "Yes, it makes the event highly unlikely,"
14 then how reliable is this thing?
15 And it's a .99 reliability or a .9
16 reliability, and what is your basis for saying so?
17 You have the data.
18 MR. MURRAY: Yeah.
19 MR. ROSEN: And if so, let me see it. You
20 know how this goes.
21 MR. MURRAY: Yes, yes.
22 MR. GIITTER: Dr. Rosen, again, all we are
23 required to do at this stage is to have a reasonable
24 assurance, and I think that's where the staff is at at
25 this point in time. And whether the applicant comes

1 in in the future with a detailed quantitative
2 evaluation, which they can do, or a qualitative
3 evaluation, we still have to be able to have a high
4 degree of assurance that the IROFs are reliability and
5 available to prevent the undesirable consequence.
6 MR. ROSEN: Does that mean that you'll
7 look at that data before you come in here and ask for
8 it, look at the reliability data for active components
9 that are used in this facility?
10 MR. MURRAY: Yes.
11 MR. ROSEN: Okay. Good.
12 MR. BROWN: If I may point out just one
13 more thing, too, one of the things we did approve
14 already is the applicant's quality assurance program
15 plan, which is for plutonium processing facility for
16 an NRC license has to comply with the Part 50,
17 Appendix B criteria, and so you know, one of the
18 things that falls out of that is the items relied on
19 for safety are designated quality level one and have
20 all of the associated, you know, quality assurance
21 measure applied to them.
22 A lot of that detail is part of the design
23 process now and will help determine later what
24 additional surveillance requirements, maintenance
25 measures are required to maintain high reliabilities.

1 A pump on its own may have only an average
2 reliability, but with additional surveillance
3 requirements, again, those details are to be provided
4 later in the license applications. It may be made
5 more reliable, that sort of thing.
6 MR. MURRAY: Let me continue on. I just
7 want to point out on this slide some of the
8 definitions for the two cases that the applicant uses.
9 The applicant has defined open and closed systems. In
10 an open system there's a vent provided, and its main
11 function is pressure release. The vent doesn't allow
12 over pressurization of the vessel from the full
13 runaway reaction of --
14 DR. WALLIS: So what goes out the vent?
15 Is it a single phase or is it a mixture?
16 MR. MURRAY: It would be a single phase.
17 DR. WALLIS: Because this reaction if it's
18 energetic enough is going to make a foaming or two-
19 phased homogeneous mixture which will swell up and go
20 out the vent.
21 MR. MURRAY: The applicant has committed
22 as part of the experimental studies to investigate
23 that phenomenon.
24 DR. WALLIS: It's very difficult to be
25 sure that you won't get this sort of homogeneity when

1 you get a reaction which is happening throughout the
2 mixture.
3 MR. MURRAY: Yes, they have --
4 DR. WALLIS: It's like opening a shaving
5 cream.
6 MR. MURRAY: Yes, yes. Now, there have
7 been tests conducted which have been sponsored by the
8 Savannah River company where these tests showed -- and
9 I'll get to it in a moment -- where venting was a very
10 effective means to prevent, if you will, the incident
11 from propagating into an event.
12 MR. ROSEN: And you can show that when you
13 vent through a relief valve that the valve is capable
14 of not only passing fully homogenized, gaseous
15 material, but also can tolerate the two-phased flow,
16 and the forces that can be caused on a component from
17 two-phased flow because I presume these valves are
18 relied on to close at some point, to shut off and
19 retain some of the inventory.
20 MR. MURRAY: That sort of more detailed
21 information would be with the license application, not
22 as part of the construction authorization, which we're
23 discussing now.
24 DR. WALLIS: When this stuff comes out of
25 this relief valve, what does it go into?

1 MR. MURRAY: It goes into the off-gas
2 treatment system for red oil.
3 DR. WALLIS: A gas treatment system?
4 MR. MURRAY: There's an off-gas treatment
5 system.
6 DR. WALLIS: I could see this stuff
7 pouring out and then continuing to react. I don't
8 know what its kinetics are. If it's hot enough --
9 MR. MURRAY: Again, at the construction
10 authorization stage we're just looking at the design
11 bases, the PSSCs. Does the proposed safety strategy
12 have the ability to render this highly unlikely?
13 DR. WALLIS: This is based on some
14 experience that this sort of thing --
15 MR. MURRAY: Often it's based on
16 experience, yes.
17 Now, a key thing about an open system is
18 if everything in that vessel container or pie were the
19 organic phase, the open system can adequately vent it
20 without any pressurization of that container or
21 vessel.
22 For a closed system, however, there's a
23 vent provided, but it has a different function. It is
24 a pathway for evaporative cooling. In essence, some
25 of the aqueous phase, as well as some of the

1 intermediate species from the breakdown of tributyl
2 phosphate are vented through this vent. They carry a
3 certain amount of enthalpy or heat with them, and that
4 allows the system as a whole to cool.
5 MR. ROSEN: It's a pressure relief valve.
6 It pops. Is that what it is, when you have a closed
7 system?
8 MR. MURRAY: In a closed system, it could
9 be a pressure relief valve.
10 MR. ROSEN: Or ruptured disk?
11 MR. MURRAY: Or ruptured disk. That sort
12 of specificity we'd expect in the license application.
13 DR. RANSOM: Out of curiosity, it would
14 sound like an open system was better, but there must
15 be some reason why they selected a closed system.
16 MR. MURRAY: Yes. The applicant expects
17 most of the vessels or containers, if you will, to be
18 open systems. As part of our interactions with the
19 applicant, we had asked the question: can we have all
20 of the vessels as open systems?
21 And the applicant said, no, there will be
22 a few systems which we would designate as a closed
23 system. Details would be provided at the ISA stage
24 with the license application.
25 But the great majority of the vessels or

1 systems would be open.

2 Okay. Let me just discuss the PSSC. The

3 first one is the off-gas treatment system. This

4 provides venting and avoids pressurization of the

5 vessel itself and allows a path or evaporative

6 cooling.

7 In the open system, it has a safety

8 function to avoid pressurization, and a design basis

9 has been identified by the applicant. Okay? And I'll

10 get to that in a little more detail in a moment, but

11 that basically defines the size of the vent on the

12 vessel.

13 For a closed system, the applicant has

14 based it upon the safety function upon evaporative

15 cooling, and it is essentially a 20 percent margin

16 above the energy put into the system, and that is

17 energy which comes from the steam heating, which is

18 used, if you will, in the evaporator, say, to

19 concentrate the material, recover nitric acid, and

20 also the heat or enthalpy which comes from the red oil

21 reactions themselves.

22 DR. FORD: Are these numbers here your

23 specifications or their specifications? How are they

24 arrived at?

25 MR. MURRAY: These are numbers from the

1 applicant. They are design bases. Okay? They're not
2 specifications.
3 DR. FORD: Okay, and you're approving
4 these at this time or is it -- do you approve them at
5 this time or do you just do it enough to have
6 reasonable assurance that you have safety, or have you
7 done it?
8 MR. MURRAY: We do this as reasonable
9 assurance.
10 DR. FORD: And how is that arrived at?
11 MR. MURRAY: We're getting there.
12 DR. FORD: Okay.
13 MR. MURRAY: First I wanted to go through
14 the PSSCs proposed by the applicant. The second PSSC
15 is the safety control subsystem. This is essentially
16 an active engineer control, and I've listed the
17 parameters here, limiting steam temperature. Okay?
18 This value comes from experience. Limit
19 organic compound residence time.
20 DR. WALLIS: How hot does it have to get
21 before it's in trouble? Is it 134 or 150 or 200 or
22 what?
23 DR. BONACA: Very close.
24 MR. MURRAY: We'll get to that in about
25 four slides.

1 DR. WALLIS: Okay.

2 MR. MURRAY: Stay tuned with me.

3 MR. ROSEN: Not much.

4 DR. WALLIS: I think it's not much.

5 MR. MURRAY: For closed systems, okay, the
6 process safety control system would limit the
7 temperature of that reacting mixture to 125 degrees
8 C., and it also would limit the temperature-ramp rate
9 to nothing greater than two degrees Centigrade.

10 DR. WALLIS: Presumably if you use
11 evaporative cooling, you're going to have to make up
12 whatever you evaporate.

13 MR. MURRAY: Yes. That's why it's called
14 aqueous phase addition.

15 DR. WALLIS: Aqueous phase addition,
16 right. Put water in and take steam out. Is that --

17 MR. MURRAY: In essence, yes. And as the
18 water evaporates into steam, it absorbs energy from
19 the mixture and cools it down.

20 MR. ROSEN: And the controllers that do
21 these are solid state controllers, the PLCs or things
22 like that, right?

23 MR. MURRAY: That's correct.

24 MR. ROSEN: Which have a reliability which
25 we know, and this will be discussed because these are

1 items relied on for safety in the ISA, I presume.

2 MR. MURRAY: Yes, in more detail in the

3 ISA. That is correct.

4 Okay. Let me just mention the third

5 control, and this is essentially a chemical safety

6 control, which is more of an administrative control.

7 It has been found from both experiments,

8 plus also investigation of past incidents and

9 accidents with red oil, that organic compounds which

10 are cyclical in nature, cyclohexane derivatives, for

11 example, can contribute significantly to the event by

12 lowering the initiation temperature.

13 To address that concern, the applicant has

14 a safety function for this chemical safety control to

15 prevent any cyclical compounds from being in the

16 diluent and, if you will, getting into the system to

17 react.

18 DR. FORD: Do you know why they lower the

19 initiation temperature?

20 MR. MURRAY: If you look at the --

21 DR. FORD: The reason why I'm asking the

22 question, is there something else that could do the

23 same thing?

24 MR. MURRAY: There are some degradation

25 products which can do the same thing as well, but

1 those are removed in the solvent treatment system at
2 the proposed facility. You know, dibutyl phosphate,
3 for example; it would be some of the butyl compounds.
4 Okay. So the solvent is treated before it
5 is reused in the Purex process, and that's where those
6 are removed. Okay?
7 DR. WALLIS: In my experience in
8 consulting with disasters in chemical plants is that
9 there's an awful lot of shakedown. You build the
10 thing, and then you do a lot of experimentation, and
11 then you fill it with things and you change the
12 temperatures and pressures until everything works
13 right, and then you find, gee, whiz, we're making some
14 cyclical organics. Therefore, you'd better do
15 something about it.
16 Is this what happens here, is sort of a
17 year or two of shakedown at the facility, or is it
18 something that you just build and it works?
19 MR. MURRAY: I will hypothesize that this
20 facility will have a shakedown period and that the NRC
21 staff would be involved with inspections during that
22 shakedown period.
23 DR. WALLIS: This is where you get some
24 more assurance that these things really work --
25 MR. MURRAY: Yes.

1 DR. WALLIS: -- and that 125 degrees C. is
2 okay and all of that?
3 MR. MURRAY: Right.
4 MR. ROSEN: But is there a way to do it
5 without plutonium and uranium dioxide powder?
6 MR. SIEBER: Yes, that's the way you do
7 it.
8 MR. MURRAY: Yes, that's how you do it.
9 MR. ROSEN: So the shakedown period is
10 non-radioactive. It's cold.
11 MR. MURRAY: The shakedown period will --
12 again, this is something which would come in as part
13 of a future phase of this program, but the shakedown
14 period usually will start with non-radioactive
15 species, and it might end, say, with the introduction
16 of something like uranium just to check out how well
17 the process would work with, if you will, some real
18 radioactive material.
19 It is possible in the future the applicant
20 might even decide to use some compound or element
21 which has similar chemical properties as plutonium
22 just to check out the facility.
23 MR. ROSEN: In the reactor world which
24 we're burdened with there's something called a start-
25 up test program which sounds analogous to your

1 shakedown period. It's part of the -- the start-up
2 test program is part of the application, which the
3 staff reviews.
4 Is there an analogous section of the ISA
5 with the shakedown program in it that you review and
6 approve?
7 MR. MURRAY: The integrated safety
8 analysis will have to look at start-up of the process,
9 steady state operation, upsets in the process, ranges
10 that the process or facility would experience, and
11 shutdown.
12 MR. ROSEN: Not quite the answer to my
13 question.
14 MR. MURRAY: I'm sorry.
15 MR. ROSEN: No, I think you almost hit it.
16 You said start-up of the operation. Did you mean
17 routine start-up or first time start-up?
18 MR. MURRAY: It should address both.
19 MR. ROSEN: Okay.
20 MR. MURRAY: Again, you know, the devil is
21 in the details, but those details should come in with
22 the license application next year.
23 DR. DENNING: Let me just challenge one
24 response you had to Graham in terms of whether you
25 really addressed what he was saying, and that was

1 Graham said that in the start-up period you'll do
2 things like determine the acceptability of like the
3 125 C. limit, and I don't think you really do. I
4 don't think in the start-up period you really do
5 anything that really determines what's the
6 acceptability of the limits or reliability of --
7 MR. MURRAY: Well, let me just clarify
8 something. The applicant has committed to an
9 experimental program to essentially define and, if you
10 will, make sure that the temperature value 125 degrees
11 Centigrade, for example, is reasonable and appropriate
12 as a design basis.
13 MR. ROSEN: I'll push your button. That
14 is not my slide there?
15 MR. MURRAY: Okay. Here it is. This is
16 a commitment they've made. The applicant will define
17 the reaction kinetics in more detail, quantitatively,
18 determine effects of impurities, and then from that
19 experimental data probably as part of testing
20 establish some operational limits and set points.
21 DR. WALLIS: How long is this going to
22 take?
23 MR. MURRAY: That has not been discussed
24 yet.
25 DR. WALLIS: Quite often research seems to

1 be done to confirm something you've already decided,
2 and you find the plant is running before you've
3 actually finished the research.
4 MR. MURRAY: It is our understanding from
5 our discussions with the applicant that this is a near
6 term research experimental program.
7 DR. WALLIS: It may be very hard. You
8 said that we don't really know these reactions. They
9 my turn out to be very tough.
10 MR. MURRAY: It could be difficult.
11 DR. WALLIS: So this is going to hold up
12 the whole plant?
13 MR. MURRAY: If problems are encountered
14 during the test program, it is possible, but that is
15 hypothetical at this time.
16 DR. FORD: What would trigger, if you go
17 back one slide, just following up on Professor Wallis'
18 question --
19 CHAIRMAN POWERS: Let me interrupt just
20 for one second. We are running behind time. This is
21 the only opportunity we have to plunge into the
22 details. So I don't want to cut off, but I would like
23 to stay focused on the issue at hand here, which is
24 the construction permit. And if you need to
25 understand the limits of the construction permit to

1 understand what's going on in the licensing permit,
2 that's fine, but if you're just curious, I would
3 prefer to stay on schedule.
4 DR. FORD: I withdraw my question.
5 MR. MURRAY: Okay. That's fine.
6 Let me get into the start, evaluation, and
7 conclusions, if I could please, and first off, for
8 open systems, the staff agrees that a preventative
9 strategy is the best approach, okay, due to the
10 potential severity of the vent, and we've noted and
11 have analyzed the multiple PSSCs and safety functions
12 identified by the applicant.
13 One key point I want to make is the design
14 basis for the vent PSSC is well within the
15 experimental range which has been determined by tests
16 conducted for the Department of Energy. Because of
17 this, that system cannot over pressurize.
18 Okay. Again, this is predicated upon the
19 fact that the vent is designed properly. I want to
20 emphasize that. Details would have to be in the ISA
21 stage.
22 Because the system cannot pressurize, it
23 is physico-chemically limited to the normal boiling
24 point of the mixture. It cannot go above that, and
25 that is up around 120 degrees Centigrade. That is

1 well below the red oil runaway temperature conditions
2 which start at around 130 or so degrees centigrade,
3 and this has been accepted by the staff.
4 And if I go to the next slide, as you can
5 see, the blue line on this curve was determined by
6 experimental studies conducted on behalf of the
7 Department of Energy. A key point to point out here
8 is that somewhere just beyond this organic mass vent
9 area ratio of about 32 kilograms per square
10 centimeter, there's a very rapid rise in the pressures
11 which were measured.
12 And because of this, the Department of
13 Energy and its contractors have identified this value
14 of about 32 as being the boundary between safe and
15 unsafe for red oil reactions. All right?
16 MR. ROSEN: Without uncertainty? There's
17 no uncertainty on that 32, or is it a degree or four
18 degrees or nine or do you have any sense of it?
19 MR. MURRAY: This data as regards
20 uncertainty, these were a series of tests. Okay? I
21 don't think the researchers went into great detail
22 about uncertainties. From our perspective, I would
23 just like to point out, again, we're looking to the
24 ability of the proposed strategy to, if you will, keep
25 the system safe, render the event highly unlikely.

1 I think it's important to realize that
2 what the applicant has proposed is considerably away
3 from this range here and well into the recommended
4 safe range. And it would seem even if there are some
5 uncertainties into where this line is exactly drawn,
6 it would seem that they would still be in the safe
7 range.
8 MR. ROSEN: It looks like it ought to be
9 based on what --
10 MR. MURRAY: Yeah.
11 MR. ROSEN: -- but on the other hand, I
12 don't know what the experiments were, and so I have no
13 sense of whether 12 versus 32 is a good number. If
14 the uncertainties are 20 on 32, it isn't. The 95
15 percent confidence limit is 20 on that 30. Then it
16 isn't.
17 So I would recommend --
18 MR. MURRAY: That sort of detail we would
19 expect to see in the integrated safety analysis as
20 part of the operating license review.
21 Now, this information I would like to
22 point out is all in the open literature. In fact,
23 everything which we are discussing today is in the
24 open literature. This was actually from a paper
25 authored by Paddleford and Fauske.

1 DR. BONACA: If they use the expression,
2 that to me would read that they had some consideration
3 of uncertainty in that ramp. That's a good question.
4 MR. MURRAY: Again, I think uncertainty is
5 a very good question, but I think at this stage with
6 the other information presented in the literature,
7 this gives the staff assurance that what the applicant
8 has proposed has the ability to render the event
9 highly unlikely.
10 Again, more specifics. Details which
11 demonstrate that the applicant has rendered this event
12 highly unlikely would have to be in the license
13 application.
14 Okay. Let me move on.
15 Let me just mention about closed systems.
16 Now, in closed systems, the applicant has identified
17 a solution temperature of not exceeding 125 degrees
18 Centigrade.
19 DR. WALLIS: I think it has to have a
20 tolerance on that or accuracy or something. Because
21 if you can only measure it within five degrees C, then
22 you could well be up to the initiation level.
23 MR. MURRAY: That sort of specificity on
24 tolerance, how quickly can controls react, you know,
25 lag time, accuracy of controls, that would have to be

1 considered in the set point analysis in the license
2 application.
3 Okay. So, for example, if the applicant
4 were using a certain type of temperature detector, for
5 example, which had an error bound of plus or minus
6 three degrees C., they would have to adjust their, if
7 you will, set point appropriately.
8 If they went with an RTD, a very nice,
9 accurate one, that only allowed .1 degrees Centigrade
10 variation. That would have less of an effect upon the
11 set point.
12 Okay. In addition, I just want to note
13 about the temperature. This is approximately five
14 degrees Centigrade below the DOE safe initiation
15 limit, and somewhere around ten degrees Centigrade
16 below runaway reaction temperatures based on Savannah
17 River site data. And, again, that information is
18 published.
19 Okay. Also, there are controls on
20 exposure of the organic materials, both TBP and
21 diluent to, if you will, the temperatures and
22 conditions which can lead to red oil, and these
23 controls from the staff analysis indicate that these
24 would prevent participation of these other, if you
25 will, species, again, cyclical compounds being one

1 example, from participating in the red oil reactions.
2 Hence, that should not depress any of the
3 reaction initiation temperatures below 130 degrees
4 Centigrade.
5 DR. WALLIS: Most of these systems don't
6 really have an initiation temperature. They have the
7 criterion for runaway, which has something to do with
8 the rate at which things change with temperature.
9 MR. MURRAY: Yes, yes, but in the chemical
10 process industry parlance, for example, that is
11 normally identified or rolled into the single
12 parameter of an Alvina (phonetic) initiation
13 temperature; that if you are below that temperature,
14 even though you could have, if you will, thermal
15 release or enthalpy from reactions, the system as a
16 whole can cool down and the temperature will not keep
17 increasing.
18 DR. WALLIS: We went into this whole thing
19 with spent fuel pools. There really isn't an
20 initiation temperature for an overheating event.
21 There's the initiation condition in which temperature
22 plays some role, and I guess this is all going to be
23 figured out properly somehow?
24 MR. MURRAY: The details would have to be
25 in the license application.

1 DR. WALLIS: Be careful about saying that
2 temperature is the only thing that matters.
3 MR. MURRAY: Well, that's why one of the
4 controls is keeping out these other organic materials,
5 because if they are present, they can depress that, if
6 you will, initiation temperature significantly, you
7 see.
8 Moving right along, temperature ramp
9 control. That essentially addresses the concern from,
10 if you will, runaway reaction enthalpy or heat of
11 reaction effects
12 DR. DENNING: Is the temperature ramp
13 control system a PSSC then?
14 MR. MURRAY: This is identified as a
15 safety function for the safety control system. It is
16 a PSSC, yes. Again, this is at a small system level
17 for the construction authorization, whereas for the
18 license application, there would be more at the
19 component level.
20 And let me just also mention there would
21 be an aqueous phase addition system which would
22 provide, if you will, water to evaporate and help cool
23 the system. All right? And this is controlled,
24 again, by that process safety control subsystem.
25 The staff also looked at the commitment

1 that the applicant has made to do further reaction
2 testing. Part of it is related to the fundamental
3 understanding of the kinetic reactions, kinetic rate
4 equations involved in red oil phenomena. Part of it
5 is also related to understanding where this initiation
6 temperature might be when other species or impurities
7 are present.
8 All right, and the staff has looked at
9 this in a total integrated perspective, and we have
10 concluded that we have assurance that the proposed
11 safety strategy, the design bases, and PSSCs can
12 prevent the event.
13 DR. CROFF: Have there been any red oil
14 events at the French plant on which this is based?
15 MR. MURRAY: I'm not aware of any
16 significant incidents or accidents being reported from
17 French facilities, and the applicant, as part of the
18 application or any subsequent information they have
19 submitted on the docket have not cited any French
20 experience.
21 CHAIRMAN POWERS: There surely must be
22 French interest because we had a young man come and
23 give us some discussion on research he was doing in
24 the red oil from France, and it was a very
25 sophisticated research program he outlined for us. I

1 think the subcommittee wished him good luck and said,
2 "Fat chance," because I think, again, the fundamental
3 problem is you can do all of the laboratory research
4 in the world and it's very difficult to assure
5 yourself that what you have in the laboratory is what
6 was in the pot.
7 DR. WEINER: How uniform is the
8 temperature in these reaction vessels?
9 MR. MURRAY: That sort of detail we would
10 expect to come in the license application. Okay? For
11 what we've looked at for the construction
12 authorization phase, we've looked at this very top
13 level. The single temperature parameter would apply
14 to everything that's in the vessel.
15 Okay. In the real world, we know there
16 are such things a temperature gradients, and again, I
17 will hypothesize that as part of the license
18 application and the set point methodology, the
19 applicant will have to take that into effect for
20 defining its temperature and other set points.
21 DR. RANSOM: Have all of the DPOs or DPVs
22 that were raised been resolved?
23 MR. MURRAY: That discussion we'll have
24 starting at 4:30.
25 CHAIRMAN POWERS: You really shouldn't ask

1 the staff to speak to this issue. It has been
2 separated out --
3 MR. MURRAY: Yes.
4 CHAIRMAN POWERS: -- into a separate, and
5 we'll get to explore it a little bit.
6 MR. MURRAY: Yes.
7 CHAIRMAN POWERS: Thank you very much.
8 That was nice.
9 What I would like to do is take about a 15
10 minute break. We are running about a half an hour
11 behind, which is an inevitable feature of subcommittee
12 meetings, and I'll ask that everybody have forbearance
13 for us on this.
14 This is the only time the members will get
15 a chance to explore these things in detail. When you
16 come to a full committee meeting, we're constrained by
17 the time schedule much more rigorously than I'm going
18 to constrain us here. But you may want to inform
19 subsequent speakers that we're running a little bit
20 behind. I'm not going to make any effort to catch up
21 on it, save to ask the members to focus on the issue
22 at hand, but if you need to go a little broader to
23 understand and put it in context, feel free because
24 otherwise you'll never get your questions answered,
25 and then you will bring them to the full committee.

1 DR. BONACA: The positive thing, the
2 philosophy that we're addressing these other issues,
3 so hopefully we --
4 CHAIRMAN POWERS: Yeah, I think this first
5 one on red oil, first of all, it is the most curious
6 and interesting phenomenon, but the philosophical
7 approach needs to be understood, and that might be a
8 good understanding here. It's very important here for
9 us to understand the philosophy. So don't be afraid
10 to wax philosophical.
11 And so let's resume at 11 o'clock.
12 (Whereupon, the foregoing matter went off
13 the record at 10:48 a.m. and went back on
14 the record at 11:05 a.m.)
15 CHAIRMAN POWERS: Let's reconvene.
16 Bill, get ready to teach us about HAN.
17 I take it in the SER when it refers to
18 hydroxy nitrate it really means hydroxylamine nitrate.
19 MR. TROSKOSKI: Yes, sir, it does.
20 Absolutely, it means what you would have right here.
21 CHAIRMAN POWERS: And you might want to go
22 through and check it. It's different nomenclature in
23 different places.
24 MR. TROSKOSKI: Sure. HAN is
25 hydroxylamine nitrate. There's an excellent DOE

1 technical report out on the subject. It's EH-0555.
2 I believe it's still on the Internet, and it's a good
3 introduction.
4 Basically, we're in the aqueous polishing
5 system, and it's a Purex system that's been around for
6 quite a few years, almost as long as some of us.
7 Right now what has happened in the process is you
8 dissolve the plutonium material with the impurities in
9 nitric acid. You contacted it with the organic phase,
10 which has the tributyl phosphate. The tributyl
11 phosphate grabs both the uranium and the plutonium,
12 and then you're going to separate the organic
13 phaseout, and you're going to hit it with another
14 dilute nitric acid solution containing HAN and
15 hydrazine, and the purpose of the HAN and hydrazine is
16 basically to extract the plutonium by changing its
17 valence from four to a three where it's soluble again
18 in the aqueous phase.
19 So the plutonium now leaves the organic.
20 It goes back to the acid phase, and then you can go
21 and further concentrate it. You've now left basically
22 most of the impurities behind, and you've got the high
23 priority product that you're after.
24 A similar process is also used to recover
25 unstripped plutonium in the last stage of the

1 plutonium barrier prior to sending the solvent back to
2 the regeneration process.
3 Hydrazine has a couple of functions. It
4 stabilizes the HAN and it also reduces some plutonium
5 while four to three. One of its functions is that it
6 reacts very quickly with nitrous acid, which is the
7 prime intermediate that we're concerned about with
8 these types of reactions.
9 Within the process itself, you can expect
10 to see HAN in both the purification systems and the
11 solvent recovery systems.
12 HAN is not a benign chemical. It's a very
13 reactive chemical. It almost could be classified as
14 an explosive under the right conditions. It can
15 undergo very rapid autocatalytic decomposition, much
16 more so than even red oil.
17 Red oil you can kind of control it by
18 controlling the off-gas because about 90 percent of
19 the energy release in a red oil reaction comes from
20 the chemical intermediates that are put off. But HAN
21 is just much quicker by orders of magnitude. So
22 pressure control is not a viable option here.
23 There are large quantities of gases
24 involved, noncondensables with this type of reaction.
25 Consequently pressure excursions for any kind of

1 closed vessel or pipe are of a concern, and we do have
2 a number of incidents that have happened both at
3 Hanford and Savannah River site that are detailed in
4 the DOE report where these have ruptured various
5 process vessels.
6 The quantities of HAN that they intend to
7 use at the MOX facility are comparable with what they
8 have used before at both Savannah River and at
9 Hanford.
10 The applicant has identified this as a
11 high consequence event, as well they should. They've
12 selected a preventive strategy to render this event
13 highly unlikely.
14 The original application had some of the
15 DOE recommendations that you've had in the 0555
16 report, but not all of them. During subsequent
17 meetings with the staff, subsequent questioning, they
18 have revised their approach until they have provided
19 multiple parameters and controls. It has most, but
20 not all of the recommendations, and they basically
21 have tailor suited it to their process.
22 Now, the safety strategy that they have
23 are based on two different cases. In one case, you're
24 going to have vessels where you have HAN and
25 hydrazine, but not MOX addition, and what you want to

1 do in a case like that is to avoid the decomposition
2 reaction together.
3 In Case 2, they are going to want to
4 destroy HAN and hydrazine before further processing.
5 So that's why they have the NOX addition. The NOX
6 will react with it, and you'll get nitrogen, oxygen,
7 water and other gases there with very little
8 additional liquid waste that you'd have to process.
9 So they induce the composition to avoid
10 recycling accumulation of the HAN in other parts of
11 the process where you would not want it.
12 Now, for Case 1, where they want to avoid
13 the decomposition reaction altogether, they've
14 developed a kinetic model based upon multiple reaction
15 mechanisms. The model will involve five partial
16 differential equations that are coupled, that have to
17 be solved simultaneously.
18 They used kinetic parameters from the
19 literature from a variety of sources that have been
20 printed throughout the years. They solved the model
21 using a commercial software program. It provided
22 predicted regions of stability and safe design base
23 limits.
24 The applicant committed to confirmatory
25 testing to substantiate the model, and a lot of the

1 safety bases and safety limits are concentrations and
2 temperatures that are in good agreement, in general,
3 with the instability index that DOE has developed
4 Yes.
5 MR. SIEBER: Yes, before you move on, what
6 are the parameters of importance that would lead to --
7 MR. TROSKOSKI: I'll get to that.
8 MR. SIEBER: -- stability?
9 MR. TROSKOSKI: That would lead to
10 stability?
11 MR. SIEBER: Yes.
12 MR. TROSKOSKI: Yes. I'll get that in
13 just a second.
14 MR. SIEBER: All right.
15 MR. TROSKOSKI: Excellent. For the
16 control case, what they want to do is maintain
17 temperature below 50 degrees C. Temperature, of
18 course, is a big input for any kind of reactor
19 reaction kinetics.
20 MR. SIEBER: Okay.
21 MR. TROSKOSKI: You want to maintain
22 concentrations of key parameters at certain levels.
23 You want to maintain a design basis for nitric acid.
24 You want to have a certain amount of hydrazine
25 available.

1 You want to have HAN at a certain amount,
2 and then the last one I think we can clarify a little
3 bit more. Limit the time in nitric acid and radiation
4 fields. What that really means is when you mix HAN
5 with nitric acid, there have been events before where
6 over a period of time a vessel has been left for
7 months or years, and the nitric acid has evaporated
8 off. So it has concentrated the HAN to a very
9 critical level where you have the reaction that
10 occurred.
11 The other thing for radiation is since
12 they're going to have a HAN-hydrazine mixture,
13 hydrazine is a nitrous acid scavenger which would kill
14 the process, but hydrazine is also susceptible to
15 radiolysis from contact with plutonium. So you need
16 to limit the time that it is in contact with that so
17 that you don't decrease the concentration of the
18 hydrazine.
19 MR. SIEBER: Is it an oxygen scavenger,
20 too?
21 MR. TROSKOSKI: Hydrazine?
22 MR. SIEBER: Yeah.
23 PARTICIPANTS: Yes.
24 MR. TROSKOSKI: Yes?
25 DR. FORD: You showed some very specific

1 limits, design base data. What is the extent of the
2 data upon which those are based?
3 MR. TROSKOSKI: It comes from various
4 literature sources.
5 DR. FORD: So you've looked at that
6 database and assured yourself that having those 50
7 degrees C. maximum, for instance, is adequate safety
8 margin?
9 MR. TROSKOSKI: Well, I believe it's the
10 next slide.
11 Well, we did review the literature
12 equations, and we developed an exercise to similar
13 model, and by that I mean there are differential
14 equations in the literature input. We used a
15 different commercial program. I think Polymath 5.1,
16 my colleagues did, and they ran a series of runs on
17 that to find the regions of stability, instability,
18 and the margin for the design basis.
19 And as a result of that, what we've found
20 is that there is substantial margin in each of the key
21 parameters there. You'll notice on the bottom the
22 HN3. We're assuming a design basis of zero molar
23 concentration. That's because it's also a nitrous
24 scavenger, and that's a conservative assumption.
25 They're ignoring that. It adds extra margin.

1 But there is a substantial margin in each
2 of the parameters.
3 DR. WALLIS: Of course, 25 percent is
4 completely inappropriate in the first line. You could
5 have used Kelvin or something.
6 DR. WEINER: Yes.
7 MR. TROSKOSKI: Yes, yes. Guilty as
8 charged, sir.
9 DR. WEINER: Absolutely.
10 DR. FORD: So just to follow up a wee bit
11 on that --
12 MR. TROSKOSKI: Sure.
13 DR. FORD: -- sine it does relate to the
14 design basis criteria, these staple values, that's a
15 mean, is it, of the database? A staple value of 53,
16 that's not a mean because it's a less than sign.
17 I'm trying to get just what is the real
18 margin.
19 CHAIRMAN POWERS: My understanding is
20 you're talking about a mathematical model.
21 MR. TROSKOSKI: Yes, a mathematical model.
22 We used --
23 DR. FORD: It's a mathematical model based
24 on a very scattered database presumably.
25 MR. TROSKOSKI: Yes. Yes, it is.

1 DR. FORD: Okay, and so if you take the
2 database --
3 MR. TROSKOSKI: How scattered is it?
4 DR. FORD: -- how scattered is it around
5 this mathematical model?
6 MR. BROWN: I did some of the computer
7 runs for this. Being a mathematical model, the
8 results produced by the model are very -- have no
9 uncertainty associated with them. It's just very
10 distinct values.
11 So in other words, at 64 degrees the
12 reactions were indicated as unstable. But at 63 it
13 was stable.
14 DR. FORD: I recognize that, but were the
15 data points, you know, below 63 in which it was
16 unstable?
17 MR. TROSKOSKI: Were the data points below
18 63?
19 DR. FORD: Were there data points? I
20 recognize that these are a model.
21 MR. MURRAY: Let me try and help and
22 explain this. Okay? If you go and look at the
23 available experimental data, that is, in the
24 literature, okay, there is a significant quantity of
25 information. Okay? Many experiments, many data

1 points.

2 One of the concerns that the staff had
3 with all of that data was that the testing tended just
4 to look at one or two of the phenomena in a multi-
5 phenomena model, if you will, real system. All right,
6 and we found from looking at it and running, if you
7 will, our own simulation that, yeah, we were generally
8 in agreement, I'll use the term "alignment" if you
9 will, with both the results of the different
10 literature articles, something like 25 major research
11 articles, okay, things like industrial engineering
12 chemistry, transcripts of the Faraday Society and all
13 that sort of stuff, you know, a lot of very good,
14 erudite work.

15 All right, but there isn't one single
16 source which looked, if you will, at the complete
17 phenomena.

18 All right. Now, we found that the model
19 predictions, they were generally in agreement if we
20 look at some of the specific test data that was there.
21 We did not explicitly look at uncertainty. One of the
22 reasons has to do with the fact that the applicant has
23 committed to confirmatory testing to actually generate
24 uncertainties.

25 When they do that testing and we on the

1 staff review that, then we'll have a much better idea
2 of the uncertainties around these parameters and what
3 needs to be done to, if you will, develop set points.
4 Okay. Either set points accommodate the
5 uncertainties both in the original data and also in
6 the monitoring --
7 DR. FORD: I understand what you did.
8 MR. MURRAY: Yes.
9 DR. FORD: And it's done in many other
10 fields also, but I still don't have a feeling as to if
11 you had -- presumably this model would give you an
12 algorithm of the unstable temperature as a function of
13 all the other variables. You could --
14 MR. MURRAY: You can numerically generate
15 that, yes.
16 DR. FORD: So if you could just give me a
17 feeling. If you then plotted, predicated instability
18 temperature versus observed data, what would the
19 correlation factor be?
20 MR. MURRAY: I don't think we have that
21 information at this time. What we have found is that
22 the results in the model at the simulations, if you
23 will, agree with some specific test points, for
24 example, the test data that is in the EH report.
25 But in terms of actual correlation

1 factors, is it always 20 percent below, you know, does
2 it vary with other parameters, you know, five percent
3 at low nitric, 20 percent at high nitric
4 concentrations? We do not have that information.
5 DR. FORD: But we've been told that the
6 passing grade, if you like, for this is to have
7 regional assurance of safety.
8 MR. MURRAY: Right.
9 DR. FORD: So can we be reasonably assured
10 that there will not be a data point which shows
11 instability below 63 degrees Centigrade if you play
12 around with your other parameters, which are all
13 within the conceivable operating descriptor.
14 MR. MURRAY: Again, with the available
15 information that we have, both test data and running
16 the mathematical model, we have reasonably assured --
17 it's not proved; it's not demonstrated -- but we have
18 reasonable assurance that there won't be, if you will,
19 a temperature below 63 degrees C. where it can become
20 unstable.
21 The proposed strategy appears to have the
22 ability to render the event highly unlikely, and
23 again, that's the criteria for construction.
24 MR. TROSKOSKI: Be careful of just picking
25 the temperature out alone because it's an interaction

1 between the concentration of the other chemicals, also
2 the ratio between some of the other chemicals.
3 If one looks to the DOE instability index
4 plot that they've got in 0555, they plot temperature
5 verse the instability index, and that's basically a
6 function, a logarithmic function of your nitric acid
7 concentration and your nitric acid to your HAN ratio,
8 and then also it takes into effect an R as a catalyst
9 of concentration there, and it actually comes up with
10 a slope, and they have test data that they have
11 plotted up above the slope, and there's a good scatter
12 there as you can see.
13 And when we compared the values that we
14 came up with here with those, we found in general
15 pretty good agreement. We didn't find anything that
16 stuck out and raised a flag to us.
17 DR. FORD: Do I understand that that left-
18 hand column there, design basis values, those are now
19 immutable? You can't change them?
20 MR. TROSKOSKI: Those are what the
21 applicant has proposed to us as a result of the
22 testing. The two-part licensing process is a bit
23 confusing. I understand that, but it's fully
24 recognized and expected once they do the testing, once
25 they do an ISA, they may end up having to go back and

1 propose changes to existing PSSCs. They may have to
2 propose new ones, and again, those would have to be
3 reviewed and approved by the staff.
4 But we fully expect as a result of the
5 testing and doing a unit level ISA on a component-by-
6 component basis where you ask what happens if you have
7 a temperature excursion, a pressure excursion or you
8 have extra volume, whatever, there may be additional
9 safety issues that will shake out then during that
10 process.
11 And, again, a lot of this is going to be
12 very unit design specific, and a lot of that essential
13 design information is just not available at this time
14 for the staff to review.
15 DR. CROFF: What is HN3?
16 MR. MURRAY: Hydrazoic acid.
17 MR. TROSKOSKI: It's one of the byproducts
18 of the hydrazine reactions.
19 MR. MURRAY: I'm sorry. Yes.
20 MR. TROSKOSKI: You also have to be
21 careful of some of the constituents that are
22 byproducts that can do other things to other parts of
23 the process. It's a complicated process.
24 MR. SIEBER: So the acid phase is building
25 up with time.

1 MR. MURRAY: Are you talking about the
2 hydrazoic acid?
3 MR. SIEBER: Yes.
4 MR. MURRAY: If there weren't controls to
5 address it, the hydrazoic acid would accumulate in the
6 system.
7 MR. SIEBER: That's right. Okay.
8 MR. MURRAY: There's a separate series of
9 controls which have been proposed by the applicant
10 which the staff has reviewed, and those proposed
11 controls appear to have the ability to prevent
12 accumulation of hydrazoic acid.
13 MR. TROSKOSKI: There are other limits
14 placed on the hydrazoic acid to keep it out of an
15 explosive concentration from forming in a gas phase.
16 MR. SIEBER: Okay.
17 CHAIRMAN POWERS: Isn't it true that
18 everyone that drives a car in America is exposed to
19 the sodium salt?
20 MR. MURRAY: Hopefully, they won't have
21 many crashes, but, yes, it has been used as the gas
22 generator for airbags, yes.
23 DR. DENNING: I don't understand a zero
24 value for the design basis of HN3. Is that below
25 detectable limits or what does that mean in a design

1 basis?

2 MR. TROSKOSKI: Actually there's going to

3 be some in there, but we used zero in the calculations

4 because it would actually act as a nitrous acid

5 scavenger. So it would tend to mute any hand reaction

6 or put it further down.

7 So by just having the design basis of zero

8 here in the assumption, it no longer has a positive

9 contribution to safety.

10 Now, for Case 2 we're going to actually

11 introduce NOX in a controlled manner to react with and

12 basically destroy any remnant HAN in hydrazine.

13 We've got a number of controls. We've got with the

14 off-gas system and then we have chemical safety

15 controls, and the parameters are basically listed in

16 the CAR table for codes. They address pressure,

17 volume, temperature, et cetera, and generally range

18 from ten to 20 percent.

19 The staff concludes that with Case 1 where

20 there is no NOX, the model and literature do predict

21 stability. The applicant has a commitment to finish

22 conducting a series of confirmatory tests which we

23 will be reviewing during the license application

24 phase, and we believe that that's acceptable for the

25 construction phase.

1 With Case 2, we believe that the codes and
2 standards are consistent with industry good practices.
3 The code methodology leads to design base values and
4 ranges, and again, we believe that this is also
5 acceptable for the construction phase.
6 And that would conclude my formal
7 presentation on this. Are there any additional
8 questions?
9 CHAIRMAN POWERS: That was great. That
10 was fine.
11 Are there any questions on this?
12 (No response.)
13 CHAIRMAN POWERS: Let's move to the
14 titanium electrolyzer.
15 MR. TROSKOSKI: I'll turn it over to my
16 colleague, Alex.
17 MR. MURRAY: Thanks, Bill.
18 Let us move on to the next subject then --
19 oh, he found it. Hey, I'm just an engineer. These
20 things are too complicated.
21 Let us move on to the electrolyzer then.
22 The open issues identified as AP-03, and it involves
23 the potential for titanium reactions or fires in the
24 electrolyzer area.
25 Now, just by way of introduction, the

1 purification process, the Purex process requires that
2 you work or use dissolved species. The feed material
3 to this facility is plutonium dioxide. So it first
4 has to be dissolved.
5 Plutonium dioxide, depending how it's
6 being produced or what the grain size is and so forth,
7 can be very difficult to dissolve under some
8 situations. To address this from a process
9 perspective, the applicant has selected an
10 electrolytic method based upon the Department of
11 Energy and Pacific Northwest Lab program results and
12 also based upon its use in the Cogema La Hague
13 facility in France.
14 Now, it's important to remember that
15 electrolysis doesn't dissolve the plutonium dioxide
16 itself. The electrolysis just produces a very reactor
17 species, a silver plus two ion, and it is that silver
18 plus two ion which actually affects the dissolution,
19 and I've given some nominal conditions there.
20 Because silver tow is a very aggressive
21 species, okay, it's a very aggressive oxidant, it can
22 be very corrosive. And the applicant has proposed the
23 use of titanium because of its corrosion resistance to
24 Silver II species.
25 And just to point out where this can

1 occur, essentially there are two units, if you will,
2 operational areas, at the proposed facility which
3 contain electrolytic dissolvers.
4 This is dissolution for the standard
5 plutonium dioxide, and this unit here can dissolve the
6 alternate feedstock materials, as well as the standard
7 plutonium dioxide. There are a total right now of
8 three electrolyzers in these two areas.
9 Now, let's get to the safety issue. The
10 staff has found that, well, titanium is a great
11 material, but it also can be a reactive metal. Its
12 use basically depends upon the conditions that it is
13 exposed to and the presence of a very stable corrosion
14 resisting film.
15 Under normal conditions in this
16 electrolyzer, however, we have some very large
17 electrical currents. We have the presence of oxygen
18 in various forms, and our concern, the staff's
19 concern, has been that an electrical fault, in effect,
20 a shorting between the electrodes could somehow
21 initiate and involve titanium reactions.
22 We also, as part of our review, looked at
23 the planned fire protection measures, and we
24 determined they would most likely not be effective on
25 titanium fires, and so we also noted that a titanium

1 type event will be very difficult to predict and also
2 to mitigate.
3 The applicant has identified this as a
4 high consequence event and has selected a preventative
5 strategy. In the original application, they had not
6 identified any controls for this potential event. In
7 the revised application, I should say, which involves
8 both some other information, they've also put on the
9 docket, the revised approach involves both passive and
10 active engineered controls.
11 Now, what is an electrolyzer? In the open
12 literature there are schematics of various designs of
13 electrolyzers. Just to give you some idea of the
14 concept, I found one related to the Pacific Northwest
15 Lab experiments. Now, this is, if you will, an
16 experimental model. It's only about a liter size,
17 maybe four inches around and 12 inches high, but it
18 does have similarities to what the applicant will be
19 proposing for the actual electrolyzers.
20 Key parts. It is cylindrical. There's a
21 center cathode compartment in here, right there.
22 Okay? There's also a porous thread material which
23 surrounds this compartment. All right? An then
24 there's an annular anode outside of that, and then you
25 have multiple electrical connections.

1 Here we go. There's the cathode
2 connection. There's the anode connection. Various
3 connector for gases and what have you. Insulating
4 materials between the electrodes. I can't make it out
5 too well here. Some means for annotation, cooling
6 jacket in this example around it, and the key part is
7 the Silver II reactive reagent is generated in this
8 outer jacket area here.
9 DR. WALLIS: Where does the silver come
10 from?
11 MR. MURRAY: Silver nitrate, which is
12 silver plus one, is dissolved in the nitric acid to
13 begin with, and when you run it through the
14 electrolyzer it is converted to Silver II
15 DR. FORD: I'm sorry. Tell me again why
16 is silver important.
17 MR. MURRAY: Silver as the plus II species
18 is a very aggressive species which has been found to
19 assist the dissolution of just about any type of
20 plutonium dioxide in nitric acid.
21 CHAIRMAN POWERS: Alex, they need to
22 understand that it's the plus VI state that's soluble.
23 Plus IV has a limited --
24 MR. MURRAY: Yes.
25 CHAIRMAN POWERS: -- it's not insoluble,

1 but less soluble. So you've got to oxidize the stuff.
2 MR. MURRAY: Right.
3 DR. FORD: So if there were chlorides
4 impurity, the thing would go crazy.
5 MR. MURRAY: In the dechlorination unit,
6 the electrolyzer is initially controlled in a
7 different operating manner to remove the chloride
8 species, yes. That's correct.
9 DR. FORD: And presumably there's strict
10 composition controls on how much chloride you have
11 there.
12 MR. MURRAY: Yes, and those limits are
13 down as a design basis in the revised FSER.
14 DR. CROFF: How much experience have they
15 had with this dechlorinator thing? Has this actually
16 been operated on any commercial or substantial scale
17 or is this new stuff?
18 MR. MURRAY: For the dechlorinators, it is
19 the staff's understanding that they have some limited
20 experimental data from France. We have not seen that
21 data. We've looked more closely at the safety issues
22 involved. In the case of a chloride containing
23 plutonium dioxide, that is the evolution of chlorine.
24 How is it addressed?
25 Okay, and as noted in the FSER, the

1 applicant has a safety strategy to address that.

2 MR. ROSEN: Now, this thing is made of

3 glass, right?

4 MR. MURRAY: This is just an example of a

5 laboratory electrolyzer, a small one which was used

6 for testing. The proposed electrolyzer which has not

7 been designed yet -- I want to emphasize that -- from

8 the information which has been given to the staff and

9 which is mentioned in the draft FSER, it will be

10 cylindrical. There will be an inner cathode

11 compartment. There will be an outer anode

12 compartment. There'll be a porous material or frit

13 (phonetic) here.

14 The applicant has mentioned that for their

15 proposed electrolyzer this will most likely be silicon

16 nitride. They can have different electrode materials

17 and so forth.

18 MR. ROSEN: You mean the body of it will

19 be silicon nitride to replace the Pyrex?

20 MR. MURRAY: This right here.

21 MR. ROSEN: Oh, the frit. What's the

22 outer?

23 MR. MURRAY: The outer container here in

24 the applicant's proposal, that is titanium.

25 MR. ROSEN: So there's a titanium cathode,

1 anode, and a titanium body in the applicant --

2 MR. MURRAY: There's a titanium shell.

3 MR. ROSEN: Okay.

4 MR. MURRAY: The electrode materials, I

5 want to say they're platinum and tantalum, but don't

6 quote me on that.

7 MR. ROSEN: So we're worried only about

8 the shell here in the applicant's proposal, although

9 here --

10 MR. SIEBER: Because it's aggressive.

11 MR. MURRAY: Yes, in this example, this is

12 purely an experimental vessel which was made out of

13 Pyrex.

14 MR. ROSEN: And the anode and cathode in

15 here were titanium.

16 MR. MURRAY: They were coated titanium, if

17 my memory is correct.

18 MR. ROSEN: And the applicant's machine is

19 going to have a titanium shell with tantalum and

20 perhaps something else.

21 MR. MURRAY: Yes.

22 MR. ROSEN: For the platinum cathodes and

23 anodes.

24 MR. MURRAY: Yes, yes.

25 MR. ROSEN: Okay.

1 MR. SIEBER: Well, this is DOE's
2 recommended way of generating a plutonium powder in
3 the calcining process. So this must have been used
4 someplace.
5 MR. MURRAY: This was part of a large
6 experimental program which Pacific Northwest Lab had
7 going at the time, and it was --
8 MR. SIEBER: At Hanford.
9 MR. MURRAY: At Hanford, and it was to
10 come up with a method for uniformly dissolving
11 plutonium dioxide.
12 MR. SIEBER: And that was in the 1970s?
13 MR. MURRAY: To about 1990.
14 MR. SIEBER: Okay.
15 MR. MURRAY: Okay?
16 MR. SIEBER: I'm familiar with that.
17 MR. MURRAY: Okay.
18 DR. FORD: Presumably when you were going
19 through the safety aspects of this you must have
20 looked at all of the variables which would give rise
21 to disintegration of the titanium anode.
22 MR. MURRAY: Yes. There is information
23 from the DOE PNL work. Some of that information is in
24 the public arena, and they do give parameters,
25 recommended parameters for controls.

1 DR. FORD: And one of the things that
2 we're looking at quite apart from the plutonium
3 dissolution was the integrity of the titanium anode as
4 a function of potential chloride concentration, salt,
5 and nitric acid concentration?
6 I keep thinking that chloride and nitric
7 acid is not a very good mixture, even for titanium.
8 MR. MURRAY: No, no.
9 CHAIRMAN POWERS: It's a wonderful
10 mixture. It's called aqua regia.
11 MR. MURRAY: That's right, royal water.
12 CHAIRMAN POWERS: It's a tremendous salt.
13 MR. SIEBER: It's a party mixture.
14 MR. MURRAY: That's right.
15 DR. FORD: So my point is that when you
16 come out with this reasonable assurance aspect, you
17 satisfied yourself that it wasn't within the
18 operational parameters, chloride concentrations,
19 polarity of nitric acid, et cetera, et cetera, that
20 you weren't going to have a problem with the titanium
21 anode dissolving.
22 CHAIRMAN POWERS: There is no titanium
23 anode.
24 MR. MURRAY: This is they're talking about
25 the shell. Okay? In this example, again, I just

1 wanted to mention look at these key attributes in
2 this experimental one. They had a titanium anode or
3 cathode -- excuse me -- in the center. Okay?
4 All right. I don't think we have any
5 specifics on what the applicant is proposing, but I
6 seem to recall that it was tantalum and platinum which
7 was presented at one of the open meetings.
8 And, again, just using this just as an
9 example to point out these key parameters.
10 DR. FORD: Again, not to jump into the
11 ISA, is it?
12 MR. MURRAY: ISA.
13 DR. FORD: ISA time period. At this point
14 we recognize it's a problem, and we're going to put
15 off control of that problem to the ISA stage; is that
16 right?
17 MR. MURRAY: No. No, we're looking for a
18 control strategy here. The applicant has proposed a
19 control strategy.
20 DR. FORD: That control strategy will
21 involve --
22 MR. MURRAY: That we'll be getting to
23 shortly.
24 DR. FORD: -- chloride.
25 MR. MURRAY: Okay. The control strategy

1 is to address the concern about a potential titanium
2 reaction incidence/fire. All right? And how is that
3 addressed and what is our review of it? Okay?
4 Now, the applicant has proposed controls
5 for the three situations which I pointed out here:
6 maintenance, a seismic event and normal operations
7 when you have an electrical fault.
8 Just to quickly summarize the controls
9 during maintenance, these are primarily administrative
10 controls. Okay? One of the key ones is you turn off
11 the electricity to the electrolyzer.
12 MR. ROSEN: Good start.
13 MR. MURRAY: And that is an excellent
14 start, right.
15 (Laughter.)
16 MR. MURRAY: Stranger things have happened
17 in life.
18 MR. ROSEN: This is a good thing to do
19 when you're shutting a process down.
20 MR. MURRAY: Yes, absolutely.
21 MR. ROSEN: Fairly elementary.
22 MR. MURRAY: Yes. Now, I just want to let
23 you know the staff has looked at this and, first off,
24 we noted from our review of the literature -- and this
25 is cited in the draft FSER -- that administrative

1 controls are the general good practice, the RAGAGEP,
2 again, if you will -- reasonably and generally
3 accepted good engineering practice for addressing, if
4 you will, a shutdown situation. All right?
5 There are parameters, DOE standards,
6 various NFPA and other industry guidance which bring
7 these type of administrative controls out in more
8 detail. That type of detail we would expect to see in
9 the license application.
10 And we would conclude that the proposed
11 controls for maintenance periods are acceptable for
12 the construction stage.
13 MR. ROSEN: Well, now you see, you put
14 this very vague "other controls." Is that because you
15 don't want me to ask?
16 When anybody does that, they always get a
17 question. "Other requirements" and procedures, can
18 you give me a feeling for what those might be? Are
19 they merge requirements?
20 MR. MURRAY: In the case of, if you will,
21 controls during shutdown, there might be additional
22 fire protection requirements. Okay? There might be
23 limitations on hot work, covering by putting some
24 clean-up requirement for the electrolyzer itself.
25 MR. ROSEN: Do they have to get inside

1 this thing during shutdowns to maintain it?

2 MR. MURRAY: It is in a large glove box.

3 Again, we do not have the details of maintenance.

4 MR. ROSEN: It's in a large glove box.

5 You've got this electrolyzer. Now do you have to open

6 the electrolyzer to get into the inside of it to

7 maintain anything in it?

8 MR. MURRAY: The staff believes that there

9 are times when, yes, that might have to be done. If

10 nothing else, just for inspections of --

11 CHAIRMAN POWERS: Cathodes and anodes have

12 to be replaced all the time.

13 MR. MURRAY: Exactly.

14 CHAIRMAN POWERS: Yeah.

15 MR. ROSEN: Okay. Now we're getting to

16 the meat of it.

17 MR. MURRAY: Okay?

18 DR. FORD: I'm sorry. Could you explain

19 what administrative controls in this RAGAGEP --

20 RAGAGEP --

21 MR. MURRAY: Reasonably and generally

22 accepted good engineering practice.

23 MR. ROSEN: We know that most of the fires

24 have started during shutdown, and now we've got an

25 electrolyzer that we know has cathodes and anodes, and

1 you have to replace them. Getting close to this. How
2 do you do that?
3 MR. MURRAY: Huh?
4 MR. ROSEN: How do you do that? It's in
5 a glovebox. So you're in an inerted environment, a
6 nitrogen environment, to begin with.
7 MR. MURRAY: This glovebox I don't think
8 is inerted.
9 MR. ROSEN: Not inerted?
10 MR. MURRAY: Not inerted. It's not a --
11 CHAIRMAN POWERS: In fact, I think you
12 would not want to inert the outer shell of a titanium
13 vessel.
14 MR. MURRAY: Right.
15 CHAIRMAN POWERS: And so I don't see why
16 you would inert it.
17 MR. MURRAY: Right.
18 MR. ROSEN: Well, trying to prevent a fire
19 actually, but it may not be --
20 DR. FORD: I would try to use the Wall
21 Street Journal headlines criterion.
22 MR. MURRAY: Okay.
23 DR. FORD: Where you can see an action
24 occurs, and they say, "Hey, they used this RAGAGEP,"
25 and I'm just trying to delve down to how detailed is

1 this. Could it withstand the Wall Street Journal
2 headlines?
3 MR. MURRAY: At the license application
4 stage it must.
5 CHAIRMAN POWERS: Alex, we've got to
6 understand. What particular part of the Code of
7 Federal Regulations refers to a Wall Street Journal
8 headlines?
9 DR. FORD: Well, I'm just --
10 (Laughter.)
11 CHAIRMAN POWERS: I mean, I just don't
12 recall that one, Peter.
13 DR. FORD: It's not.
14 CHAIRMAN POWERS: In fact, I think it
15 would be Presidential Directive 101.
16 MR. MURRAY: Okay, and we --
17 DR. FORD: Because reasonably and
18 generally accepted to me means it's something that is
19 mundane, like you sweep the floor or you -- something
20 that is mundane.
21 MR. MURRAY: Well, no.
22 DR. FORD: Whereas this is a very highly
23 complicated --
24 MR. MURRAY: Reasonably and generally
25 accepted good engineering practice can be quite

complex. Okay? For example, DOE has a standard on handling reactive metals, and FPA has a standard for handling titanium. Okay? These are the things you are supposed to do, you know. You're not supposed to have it energized. You're not supposed to, if you're doing hot work --

DR. FORD: So it's far more sophisticated than --

MR. MURRAY: Right, right.

DR. FORD: Okay.

MR. MURRAY: And we expect that at the license application stage these types of things will be written into procedures, including addressing clean-out, addressing replacement of electrodes, that type of thing, inspection requirements for corrosion concerns, what have you.

DR. DENNING: As a general practice, you'd like to minimize administrative controls, right?

MR. MURRAY: Yes.

DR. DENNING: I mean, that is -- and you decided here that it is acceptable, however, to use administrative controls here.

MR. MURRAY: This is only when it is shut down. Okay? And it is our understanding from discussions with the applicant, plus the information

1 they have provided on the docket, that it will be shut
2 down a relatively small percentage of the time.
3 DR. DENNING: But this is something that
4 you could automate. I mean, it isn't something that
5 you -- and maybe I'm wrong. Maybe there really is a
6 penalty here to go into things that would
7 automatically terminate the power there when you did
8 something, opened the door, went into a certain mode.
9 MR. MURRAY: Right.
10 DR. DENNING: Is there a reason why? I
11 mean, did you look into that to say why not do
12 something that's automatic rather than accepting
13 administrative control?
14 MR. MURRAY: We did consider that, and we
15 do anticipate that there may be some sort of
16 maintenance related interlock at a later time. such
17 information would be in the license application.
18 If you look at the standard codes,
19 particularly the DOE and the NFPA code on titanium --
20 I keep wanting to say NFPA 481, but I don't quote me
21 on that -- if you look at those, they are primarily
22 administrative. Okay? I don't recall specific
23 interlocks mentioned.
24 However, that is an option that the
25 applicant has, and as we get more into review of the

1 detailed designs in the ISA at the license application
2 stage, we will proceed from there.
3 DR. DENNING: But you don't take the
4 position and then challenge the applicant and say why
5 -- or am I pressing this too much? Is this just not
6 an important enough administrative control?
7 But I would think, in general, you would
8 say, "I don't accept administrative controls. Explain
9 to me why this has to be an administrative control."
10 Are you taking that position or just
11 because it's accepted in other areas as good practice
12 to allow it to be administrative control you would
13 allow it?
14 MR. MURRAY: At the present time we have
15 asked the question of the applicant: what controls
16 would you apply during maintenance activities? Okay?
17 And we have expressed our preference for,
18 if you will, engineering controls over administrative
19 controls. That is a preference, not a requirement.
20 The applicant came back with a safety
21 strategy based upon administrative controls.
22 Evaluation at this time for a construction
23 authorization is that what the applicant has proposed
24 is reasonable, consistent with good practice, and has
25 the ability to prevent the event, which is what we

1 need at this time.

2 Now, the question which you're asking, if

3 you were to challenge the applicant, are there

4 specific interlock type controls that should be part

5 of that administrative procedure, if you will, or the

6 control strategy for maintenance? We would have to

7 look at the license application. Okay?

8 MR. ROSEN: I think we have expressed our

9 interest in controls during maintenance, and

10 especially in the electrolyzer, and would expect to

11 see quite a bit of detail in the ISA.

12 MR. MURRAY: Yes, yes, yes. That's

13 correct.

14 MR. ROSEN: And in your review of it.

15 MR. MURRAY: Yes.

16 MR. ROSEN: Including such things as

17 sequence, sequences of operations during maintenance.

18 MR. MURRAY: Yes, yes.

19 DR. CROFF: I'd like to generalize my --

20 I had previously asked about experience with the

21 dechlorinator.

22 MR. MURRAY: Yes.

23 DR. CROFF: Is there any experience with

24 the standard electrolyzer, the one that doesn't

25 dechlorinate?

1 MR. MURRAY: There is at the Cogema La
2 Hague launch, yes.
3 DR. CROFF: Okay. So they have used one
4 of these for --
5 MR. MURRAY: yes.
6 DR. CROFF: Okay.
7 MR. MURRAY: It is used. I think it's in
8 a scrap recycle part of the plant.
9 DR. CROFF: Okay, and any feedback on
10 their experience? Any bad experiences?
11 MR. MURRAY: We've only had limited
12 feedback, which we did not use in the safety
13 evaluation.
14 Can we move on here?
15 CHAIRMAN POWERS: Could I just ask one
16 more question about the maintenance?
17 MR. MURRAY: Certainly.
18 CHAIRMAN POWERS: If I'm doing maintenance
19 on an electrolyzer where I have to shut off the power
20 and presumably pull cathodes, in the worst conceivable
21 event, that is, a total ignition, how much could I
22 possibly release?
23 MR. MURRAY: How much plutonium material?
24 CHAIRMAN POWERS: Yeah. Obviously I will
25 have emptied it.

1 MR. MURRAY: We would expect that the
2 administrative controls would have some requirement
3 for clean-out, yes.
4 CHAIRMAN POWERS: And if I'm cleaning it
5 out, it seems to me like I'm going to have zip
6 release.
7 MR. MURRAY: Yes.
8 CHAIRMAN POWERS: In the worst conceivable
9 event I can get, I don't think I can violate any site
10 boundaries with a cleaned out electrolyzer.
11 MR. MURRAY: Yes, yes, and if you look at
12 the DOE standard, for example, for handling titanium
13 vessels, they actually mention vessels should have all
14 material drained, and they should be cleaned out.
15 CHAIRMAN POWERS: Yeah, you almost have to
16 do it in order to do anything on the vessel.
17 MR. MURRAY: Yeah. The applicant did not
18 identify the DOE standard or NFPA --
19 CHAIRMAN POWERS: That's interesting.
20 That's interesting.
21 MR. MURRAY: -- yeah, as a design basis,
22 but the approach is reasonable and in alignment with
23 generally accepted practice.
24 CHAIRMAN POWERS: Yeah. I don't have any
25 trouble with that.

1 MR. MURRAY: Let me move on to the seismic
2 event. The applicant has identified two controls
3 here. One is the electrolyzer structure, and the
4 second is what they call the seismic trip system,
5 which is part of the process safety control subsystem
6 or PSCS.
7 And I've listed the safety functions
8 there.
9 And the staff looked at this and reviewed
10 it, and we note we even did a top level fault tree
11 analysis of this, and we found that there were two
12 independent controls. We also found that the
13 frequency of potential seismic events was relatively
14 low, and we noted that the termination of the
15 electricity prevented the event.
16 And in conclusion, we noted that having
17 these two separate types of controls, in addition to
18 the low frequency of the initiating event, that the
19 approach should have the ability to render the
20 titanium event highly unlikely, and that's acceptable.
21 DR. WALLIS: What does "maintain geometry
22 for criticality purposes" mean? Does that have
23 anything to do with switching off for power?
24 MR. MURRAY: The electrolyzer structure is
25 also identified for addressing criticality events.

1 That's --

2 CHAIRMAN POWERS: It's got to be critical

3 safe --

4 MR. MURRAY: Yes.

5 CHAIRMAN POWERS: -- configuration.

6 DR. WALLIS: You mean it could get into a

7 more critical configuration in the event of a seismic

8 event?

9 MR. MURRAY: If the vessel itself, the

10 structure itself were to fail, you could have

11 unfavorable geometry form on the floor, on the bottom

12 of the glove box conceivably.

13 CHAIRMAN POWERS: Right. I don't know how

14 they design it, but I would expect that flooding would

15 get you into a more potential criticality.

16 MR. SIEBER: I would think so.

17 CHAIRMAN POWERS: If flooding external.

18 DR. WALLIS: It's a moderator there.

19 CHAIRMAN POWERS: An additional moderator

20 I would think. I don't know what the design basis is.

21 MR. MURRAY: That's in the criticality

22 section.

23 MR. SIEBER: I would presume that they

24 would control the size of the electrolyzer so that you

25 would not have enough mass in order to have a critical

1 assembly.

2 MR. MURRAY: Again, you're getting into

3 the criticality safety area, and this component was

4 reviewed and the control strategy --

5 MR. SIEBER: Well, I will be patient and

6 wait for that.

7 MR. MURRAY: Yes, but just you know --

8 DR. WALLIS: So out of context really.

9 MR. MURRAY: But just to let you know,

10 appropriate design bases were identified for

11 addressing criticality concerns in this area and for

12 more details, ask Chris.

13 CHAIRMAN POWERS: The problem in

14 criticality analyses with plutonium is you get this

15 obnoxious plutonium hydroxide if your nitric acid

16 concentration drops -- I forget the limits -- like

17 about three molar, and so it's no longer a homogeneous

18 solution, and things that you thought were critical

19 safe based on geometry suddenly become not critical

20 safe. They get flooded.

21 MR. MURRAY: Yes.

22 MR. SIEBER: Well, there's some other

23 aspects, too. You really don't know what plutonium

24 isotopes you have.

25 CHAIRMAN POWERS: They probably know

1 pretty well here.

2 MR. MURRAY: Yes, yes.

3 MR. SIEBER: Well, it's not all that clear

4 because it changes over time.

5 CHAIRMAN POWERS: It comes in with a

6 sheet that says here are the isotopes.

7 MR. SIEBER: And a little box, right.

8 MR. MURRAY: Let me just move along then.

9 Now, the controls for the electrical fault during

10 normal operations, the applicant has identified both

11 passive and active engineered controls. The passive

12 controls are essentially the sintered frit barrier,

13 which is, if you will, the porous material, semi-

14 porous material between the two compartments, and also

15 various elastomeric materials, which are listed here.

16 PTFE is polytetrafluoroethylene.

17 Sometimes the brand name is called Teflon, and as you

18 can see, these components have safety functions of

19 preventing anode/cathodes, anode/ground from

20 contacting each other.

21 In addition, the applicant has proposed an

22 active engineered control, and I've listed the safety

23 functions here. Basically these are related to

24 shutting down the electricity into the unit, and that

25 these two trip circuits would be part of the process

1 safety control subsystem.

2 Now, the applicant did not provide any

3 additional information, such as experience from

4 France, reference or what have you. So the staff did

5 a lot of analyses on this.

6 And we did do a top level fault tree. We

7 used some generic information from Savannah River

8 site, Idaho, and some codes and standards, and we

9 found that the combination of both passive and active

10 controls appeared to have the ability of making the

11 event highly unlikely.

12 We also found stated in the literature

13 that active engineered controls detecting fault

14 conditions, shutting power off, over voltage, over

15 current protection, et cetera are also, if you will,

16 good engineering practice, which is often used in the

17 electrochemical industry, and we concluded that this

18 safety strategy was appropriate for the construction

19 stage.

20 And I believe that concludes this part,

21 and we're back on schedule.

22 MR. ROSEN: Most remarkable, Mr. Chairman,

23 most remarkable.

24 CHAIRMAN POWERS: I'll have to admit every

25 titanium fire I know of did not come from electrical

1 current. It came from hot work.

2 MR. MURRAY: If you go and look at the

3 events which have happened, okay, there have been

4 somewhere between five and ten events which involved

5 hot work, nearby sparks, in one case even a battery

6 powered device, okay, that imparted sufficient energy

7 to titanium tube materials to start the reactions, and

8 that was the staff concerns.

9 Now, the staff did consult some experts at

10 the agency here who have experience handling titanium

11 materials. We presented the electrolyzer conditions,

12 typical voltage, currents, and what have you, and they

13 expressed concerns that in that situation it would be

14 hard to argue that a titanium fire would not be

15 initiated.

16 CHAIRMAN POWERS: Yeah, I don't doubt that

17 it could. It seems to me maintenance in the glovebox

18 is one of the bigger things to worry about.

19 MR. MURRAY: Yes, yes.

20 CHAIRMAN POWERS: Any other questions to

21 Alex?

22 I presume that you're willing to cover

23 this and previous topics as well.

24 MR. MURRAY: Sure, sure.

25 (Laughter.)

1 MR. MURRAY: Any depth or any breadth
2 you'd like.
3 DR. FORD: Alex, I have a question of the
4 electrolyzer.
5 MR. MURRAY: Certainly.
6 DR. FORD: Surely, aren't you going to
7 have copious amounts of hydrogen being emitted?
8 MR. MURRAY: That will be discussed this
9 afternoon in the flammability part. Okay? We actually
10 have a nice, cute little figure to show you, which is
11 also from the Pacific Northwest Lab results, and this
12 shows hydrogen generation as a function of nitric acid
13 concentration.
14 And the applicant has proposed a strategy
15 based upon having a minimum nitric acid concentration.
16 If you take that curve at that nitric acid
17 concentration, the hydrogen generation will be below
18 the lower flammability limit by a pretty good margin.
19 CHAIRMAN POWERS: And understand now you
20 have a tradeoff in your criticality safety because the
21 plutonium hydroxide polymer can be a real pain in the
22 neck.
23 Any other questions?
24 (No response.)
25 CHAIRMAN POWERS: Well, seeing none, then

1 I'll recess this until one o'clock, I guess.

2 Thank you very much.

3 (Whereupon, at 12:02 p.m., the

4 subcommittee meeting was adjourned, to reconvene at

5 1:00 p.m., the same day.)

1 AFTERNOON SESSION

2 (1:02 p.m.)

3 CHAIRMAN POWERS: Let's come back into

4 session.

5 I think we're moving on toward one of the

6 really exciting areas, uranium burnback, and I don't

7 know what. Have we got a speaker? Oh, Dave is going

8 to do it extemporaneously, right?

9 MR. BROWN: I will.

10 CHAIRMAN POWERS: This is one that you can

11 do extemporaneously.

12 MR. BROWN: As soon as Alex gets here,

13 I'll sit beside you.

14 The concern here is the fact that this

15 mixed oxide fuel will, of course, contain a depleted

16 uranium oxide component. That material has been

17 observed to undergo what we've called burnback, which

18 is oxidation from the UO_2 to U_3O_8.

19 The area where that is a hazard is where

20 the uranium is a powder, not yet commingled with the

21 plutonium, but it has been ball-milled to a very fine

22 particle size and, as a result, has a fairly high

23 surface area, specific surface area, if you will, and

24 most of that -- and I'm sorry. I said when it was not

25 commingled with plutonium. That hazard exists

1 throughout so long as it's an unconsolidated powder
2 through the barriers of the process that are here
3 marked in red.
4 So when the powder has been consolidated
5 into a pellet, that's when essentially the hazard of
6 burnback has been removed because at that point
7 there's no longer enough specific surface area to
8 cause this high oxidation.
9 DR. WALLIS: Where is this oxygen coming
10 from?
11 MR. BROWN: The oxygen that supports the
12 burnback? From there in the vicinity of the powder.
13 I'm sorry?
14 DR. WALLIS: So it's in the air?
15 MR. BROWN: Yes, and so for example, where
16 burnback has been observed before is anywhere where
17 air has been allowed to get into that process area
18 either by opening a drum containing the powder or by
19 simply allowing air instead of allowing nitrogen to
20 get into a glovebox, for example.
21 CHAIRMAN POWERS: Alex, we were running a
22 test to see if the PM had been listening to you or
23 not.
24 MR. MURRAY: Okay.
25 CHAIRMAN POWERS: He's doing pretty well,

1 actually. He's doing real well.

2 MR. BROWN: But I will step aside.

3 (Laughter.)

4 MR. MURRAY: Maybe I should have circled

5 the block.

6 (Laughter.)

7 MR. MURRAY: Thank you, Dave.

8 Okay. Sorry about that. Trying to get a

9 CD burner to work and it is so far not responding.

10 CHAIRMAN POWERS: Too many safety

11 interlocks.

12 MR. MURRAY: That must be it.

13 As Dave was just mentioning, you know,

14 burnback reactions, they do require oxygen from the

15 air or another source. They can occur quite rapidly

16 and get to some reasonably high temperatures, several

17 hundred degrees centigrade, maybe even up to the 600

18 degrees centigrade degree range quite quickly.

19 One thing about burnback, particularly

20 with events which have occurred historically, they can

21 initiate other reactions and/or disbursal of material,

22 and at the proposed max facility, the main concern is

23 with the ball-milled material because that is a very

24 fine material. It also is being blended with

25 plutonium dioxide. So you have, if you will, a decent

1 source term there as well.

2 And one of the things to keep in mind

3 which has been found is that the burnback is

4 essentially a kinetically limited reaction. In order

5 for it to occur rapidly, you have to have small

6 particle sizes generally less than about ten microns.

7 CHAIRMAN POWERS: What do you mean by

8 kinetically limited? You're talking about the

9 chemical kinetics at the surface?

10 MR. MURRAY: I'm using the term

11 "kinetically limited" to mean that the uranium dioxide

12 is fundamentally unstable from a thermodynamic

13 viewpoint under normal conditions. Okay? In the

14 atmosphere with the 20 percent partial pressure

15 fraction of oxygen.

16 However, if it is of a sufficiently large

17 particle size, if you will, the amount of material

18 that can participate in the reaction is so slow it

19 cannot, if you will, heat up and react faster which

20 would occur if you had a finer particle size, things

21 of that nature. It is fundamentally kinetically

22 limited.

23 So, for example, if you have a very fine

24 powder, it can undergo burnback reactions if it can be

25 initiated at room temperature. You just sufficiently

1 disturb it or in the presence of air and it will
2 react.
3 If you have material a little courser,
4 generally, say, in the 20 microns range, you generally
5 need about 60 to 100 degrees centigrade. If you're
6 dealing with something like pallets, for example, you
7 generally have to heat those up to something like 300
8 to 400 degrees centigrade.
9 DR. WALLIS: It doesn't make a difference
10 how it's disbursed if it's just in a pile like that.
11 Presumably it eats up all of the oxygen in the pile.
12 It only burns on the surface, but if you disburse it,
13 fluff it up and puff it up into a cloud --
14 MR. MURRAY: Yes.
15 DR. WALLIS: -- it's going to react more
16 quickly.
17 MR. MURRAY: That is correct. It's a
18 little bit like a dust cloud.
19 DR. WALLIS: Yes.
20 MR. SIEBER: Yes, or coal dust.
21 MR. MURRAY: Yes, like a dust cloud, yes,
22 exactly.
23 MR. SIEBER: But you don't need an
24 ignition source.
25 MR. MURRAY: If the material is fine

1 enough, a small enough diameter, that's correct. You
2 don't need in your resource. It purely is mass
3 transfer limited.
4 And I just included standard pictures of
5 uranium dioxide and plutonium dioxide.
6 Now, the applicant has proposed a safety
7 approach to address this event, and this involves a
8 preventative strategy to remove fine depleted uranium
9 oxide particles before they can impact the HEPA
10 filters, and if these fine particles are removed
11 before they impact the HEPA filters, this allows the
12 HEPA filters to continue to perform their safety
13 functions, which is essentially a confinement barrier.
14 And the safety controls I just want to
15 point out in the original application, the applicant
16 did not have any safety controls identified in the
17 revised CAR, revised construction authorization
18 request, which was received this past summer. They
19 included PSSCs to address this event, and these are
20 two high strength metal pre-filters.
21 And here's the description of the
22 applicant's safety controls, two high strength
23 stainless steel mesh pre-filters. They sometimes use
24 the term "spark arresters" in the application. They
25 also have two after the air stream has passed through

1 these metal pre-filters. They also have two HEPA
2 filter elements, all within the same housing.
3 In addition, you have the standard
4 redundancy of an air handling system.
5 DR. WALLIS: I don't understand this at
6 all. You've got a filter which collects the particles
7 of uranium oxide?
8 MR. MURRAY: Right.
9 DR. WALLIS: And the air is blowing
10 through it. So why doesn't it react and blow it on
11 the filter?
12 MR. MURRAY: Well, it can react on the
13 metal pre-filter.
14 DR. WALLIS: So you make yellow cake on
15 the filter.
16 MR. MURRAY: Right. The safety strategy
17 is to prevent the uranium dioxide particles from, if
18 you will, reaching the HEPA filter elements.
19 DR. WALLIS: You don't care if they burn
20 then.
21 CHAIRMAN POWERS: That would not be yellow
22 cake. It's uraninite.
23 MR. MURRAY: Huh?
24 CHAIRMAN POWERS: You would not make
25 yellow cake.

1 MR. MURRAY: No.

2 CHAIRMAN POWERS: You would make

3 uraninite.

4 MR. MURRAY: Yes, that's correct.

5 DR. WALLIS: Why is that high strength?

6 MR. MURRAY: To take potential temperature

7 extremes and even pressure delta pet peak

8 considerations across the metal pre-filters because

9 burnback reactions in past instances have achieved

10 temperatures as high as 600 or so degrees Centigrade.

11 You know, if you have it out of stainless steel,

12 that's a completely different matter as having it in

13 a HEPA filter.

14 Again, the key thing is prevent the

15 material from reaching the HEPA filter.

16 MR. SIEBER: That's all you protect though

17 because uranium dioxide lines are going to be

18 everyplace in the system where there's any kind of a

19 leak. So the potential of rapid oxidation is always

20 going to be where the material will collect.

21 MR. MURRAY: That's right. That is

22 correct.

23 MR. SIEBER: So you don't worry about that

24 so much as the boundary, which is the filter.

25 MR. MURRAY: Exactly, exactly. The

1 concern is maintaining the confinement boundary is the
2 HEPA filter.
3 MR. ROSEN: So the idea is to burn right
4 there in those stainless steel pre-filters, right?
5 MR. MURRAY: Potentially, yes.
6 MR. ROSEN: I mean, the idea is to burn it
7 up before it has to get to the HEPA.
8 MR. MURRAY: That's correct, yes. Before
9 it can, if you will, impact and damage the HEPA
10 filters.
11 MR. ROSEN: So you expect this to happen
12 once in a while, to have some burnback in those
13 filters.
14 MR. MURRAY: Yes, conceivably.
15 Now, I will add -- and we'll get to this
16 a little more in a moment -- in the process, in the
17 applicant's proposed design, where powders are
18 handled, they're under nitrogen. Okay? They have not
19 identified nitrogen as, if you will, or the supply of
20 nitrogen as being a safety control.
21 As a matter of fact, as the air streams
22 come together from the different powder process
23 gloveboxes, some of the other gloveboxes are normal
24 atmosphere. So by the time the mixture reaches the
25 final plenums where the C4 HEPA filters are, you

1 actually have, if you will, an air stream or close to
2 an air stream.
3 Okay, and on this slide I've used some
4 other design basis information for the HEPA filters
5 and the ventilation system. The pressure drop design
6 for ten inches of water pressure or less, the fire
7 barriers between areas and also the applicant has also
8 identified administrative controls for inspection and
9 maintenance of the HEPA filters.
10 Okay. Here I'm just giving some specifics
11 on the two pre-filters, and as you can see, they have
12 a design basis of removing 90 percent of the particles
13 greater than one micro in size, and again, the safety
14 function is a protection of the HEPAs.
15 Do you have a question, Dana?
16 CHAIRMAN POWERS: Not on this in
17 particular, but in the SER you go on -- in fact, you
18 don't go on, but who ever wrote this thing goes on and
19 then discusses the potential for burnback and
20 substoichiometric plutonium dioxide, and it's
21 presented more as a plausibility argument than the
22 basis of any experience, and I certainly don't know a
23 burnback in substoichiometric plutonium dioxide, and
24 I wondered. I mean, the reason you get burnback here
25 is a peculiarity of the partial molar free energy of

1 oxygen going into uranium dioxide.

2 MR. MURRAY: Yes, yes.

3 CHAIRMAN POWERS: I mean taking it over to

4 first U_4O_9 and then on to U_3O_8.

5 In the substoichiometric plutonium

6 dioxide, you've got a different situation. Unless

7 you're wildly substoichiometric -- and I don't know of

8 anybody that's producing wildly substoichiometric

9 plutonium dioxide -- you're going to go from a little

10 bit below stoichiometry to a little less below

11 stoichiometry.

12 I mean, it's not the same magnitude of

13 thermal effect. Did somebody do any sort of

14 calculations to suggest there could actually be a

15 burnback effect in substoichiometric or is it just a

16 plausibility argument? It's presented more like a

17 plausibility argument.

18 MR. MURRAY: Yes. On the south tract

19 (phonetic) of the plutonium dioxide or

20 substoichiometric plutonium dioxide, that is from

21 information supplied by Los Alamos.

22 CHAIRMAN POWERS: Okay.

23 MR. MURRAY: And it primarily relates to

24 the sesquioxide PU_2O_3 up to PUO_2, perhaps PUO_2 plus .05

25 or 2.05, 2.1, and from the information we found, the

1 enthalpy effect is far less. That's why they're sort
2 of handled separately in the revised -- I should say
3 in the FSER.
4 CHAIRMAN POWERS: Yeah, it's kind of a
5 confused argument because it does talk about the
6 superstoichiometric material or oxygen or water
7 absorption of plutonium dioxide, but I don't know of
8 anybody that has actually produced superstoichiometric
9 plutonium dioxide. Dave Hanshe (phonetic) gets some
10 stuff that has water absorption on it, but I mean,
11 that's not really superstoichiometric.
12 MR. MURRAY: Most of the information which
13 we found was related to other volatile species, but
14 the substoichiometric to slightly superstoichiometric
15 PUO_2 concern arose from one of the researchers at Los
16 Alamos.
17 CHAIRMAN POWERS: Okay.
18 MR. MURRAY: And the applicant has an
19 approach for addressing those type of concerns in
20 addition to the volatile concerns, and that's
21 discussed in the FSER.
22 CHAIRMAN POWERS: Yeah. I mean, it's a
23 little different than this. You've actually -- this
24 has actually occurred in a couple of the fuel plants.
25 MR. MURRAY: Events have occurred. Plus

1 the fuel cycle licensees which manufacture UO_2 fuel,
2 the way they process the fuel, their comment is it's
3 a process argument. They usually do a number of steps
4 which limit the reactivity of the UO_2 powders.
5 CHAIRMAN POWERS: Yeah. In fact, if you
6 processed all of your powders in air, you would never
7 get a burnback.
8 MR. MURRAY: That's right because it would
9 oxidize.
10 CHAIRMAN POWERS: Because you're doing it
11 in the inert atmosphere --
12 MR. MURRAY: Right.
13 CHAIRMAN POWERS: -- that you even have
14 the potential of getting burnback.
15 MR. MURRAY: That's right. That's right.
16 And they usually do something to control the amount of
17 oxidation so that it just occurs at the surface as it
18 is loaded into a container, for example.
19 CHAIRMAN POWERS: Okay. Any other
20 questions about the fascinating world of burnback?
21 It's fun.
22 MR. MURRAY: Yeah.
23 CHAIRMAN POWERS: I mean, Alex did not go
24 into decrepitation and the fact that it takes these
25 ten micron particles and converts them into submicron

1 particles.

2 MR. ROSEN: It's own fuel.

3 CHAIRMAN POWERS: It kind of decrepitates.

4 I mean, there's all kinds of excitement. Plus things

5 on surfaces bounce along the surfaces and things like

6 that.

7 MR. MURRAY: Yes, an example of unique

8 phenomena which occur.

9 I just wanted to also mention that the

10 applicant has identified what they call APFs or

11 additional protective features, and for uranium

12 burnback, I have listed them here.

13 CHAIRMAN POWERS: Delivered to the site in

14 sealed drums. That's why you have the problem.

15 (Laughter.)

16 CHAIRMAN POWERS: You wouldn't have the

17 problem if they didn't do that.

18 MR. MURRAY: That's correct.

19 MR. ROSEN: You'd have the burnback

20 someplace else.

21 CHAIRMAN POWERS: Yeah, when you filled

22 the drum.

23 MR. MURRAY: Yes, sir. Again, about the

24 burnback phenomena, it's a question of where it occurs

25 and to what extent, and if it's in an area where you

1 can handle it and where confinement boundaries and
2 HEPA filters are not challenged, in effect, you've
3 prevented the event from impacting those confinement
4 barriers.
5 CHAIRMAN POWERS: The biggest change I
6 think they made is in their choice of materials for
7 their HEPAs. I mean, they are relatively immune to --
8 MR. MURRAY: Yeah, they're much more
9 robust.
10 CHAIRMAN POWERS: Yeah. I mean, other
11 places where we had the old paper HEPAs, it just
12 really couldn't survive this kind of thing at all.
13 MR. MURRAY: Right, right.
14 CHAIRMAN POWERS: And they couldn't take
15 any loading. That was the big problem, was they
16 couldn't take any heavy particulate loading so that
17 they blow out and you'd get the entire inventory of
18 the filter.
19 MR. MURRAY: Yes, yes, that's correct.
20 I just want to summarize the staff
21 evaluation. We postulated that there could be a
22 glovebox spill or fire that could disburse these fine
23 UO_2 particles into the ventilation system, and the C4
24 ventilation system is the glovebox ventilation system.
25 Okay?

1 And from an analysis, we looked at ball-
2 milled material, which would be the finest material in
3 the facility, and we found that the amount which could
4 end up being deposited on the HEPAs after going
5 through the system, going through the stainless steel
6 mesh pre-filters would be something around ten to 25
7 percent of that needed to cause temperature damage.
8 And we concluded that this was an adequate
9 safety strategy. The HEPAs could survive a burnback
10 reaction, and they could continue to perform the
11 safety function.
12 Any questions?
13 CHAIRMAN POWERS: Any other questions?
14 (No response.)
15 CHAIRMAN POWERS: Well, you guys don't
16 like -- either ate too much lunch or just don't like
17 burnback.
18 (Laughter.)
19 CHAIRMAN POWERS: Let's go talk about
20 TEELS.
21 MR. MURRAY: Okay. The next subject area
22 we're going to look at is what are called TEELS, and
23 I'll also use the term "chemical limits," "chemical
24 consequence limits."
25 And for the revised Part 70, as was

1 discussed this morning, both high and intermediate
2 consequence chemical events are identified as needing
3 to be addressed in the application.
4 In order to define what are high and
5 intermediate consequence events, you have to have
6 chemical levels or criteria, and these limits are
7 shown as parts of the regulation where they are
8 important and cited. These limits should address, if
9 you will, or should be, I should say, quantitative
10 standards that relate to acute chemical exposure
11 levels.
12 Okay. These are not long term exposure
13 levels, not, if you will, occupancy type levels.
14 These are levels which are appropriate for potential
15 events and accidents.
16 Let me just mention what the safety issue
17 is. These chemical limits essentially are used to
18 determine what the safety controls and the design
19 bases are. No, in the standard review plan for MOX,
20 several are mentioned, AEGLs, A-E-G-Ls, which are from
21 the EPA and National Academy of Science, and there's
22 a number of people involved with that.
23 There are also ERPGs, which are emergency
24 response planning guidelines which come from an
25 industry group, and the SRP also mentions limits from

1 OSHA and NIOSH. PELs are permissible exposure levels,
2 a little more like occupancy levels. STs are short-
3 term exposure limits. Cs refers to ceiling limits.
4 Okay, and of course, the standard review
5 plan says that the applicant may use an alternative,
6 provided that they adequately justify it.
7 Now, as part of our review of the CAR
8 application and related information, we found that
9 there can be significant variations between all of
10 these limits, and that can affect the selection of
11 safety controls.
12 DR. FORD: So which one do you choose?
13 MR. MURRAY: He's a good straight man.
14 (Laughter.)
15 MR. MURRAY: We're getting there, and
16 that's where we're going to.
17 Now, in the initial application, the
18 applicant did not have any chemical limits identified.
19 Okay? In the revised application, including the
20 application which came in in June 2004, they have
21 values in Table 8-5 of the application which are based
22 on a combination of TEELS, which are temporary
23 emergency exposure limits, and ERPGs. Okay?
24 So the staff went and looked at these
25 revised application values and went from there.

1 Now, when you have these different limits,
2 generally they have three levels. You have a Level
3 III, which as AEGL-3, ERPG-3, TEEL-3, and these can
4 correspond, if you will, to a high consequence type
5 event.
6 You can have Level IIs, which usually
7 correspond to a more intermediate event. I should say
8 a high consequence event is usually life threatening
9 or with part of the definition includes life
10 threatening effects. An intermediate effect can be a
11 significant injury, but the person is still able to
12 escape from the area.
13 And then, of course, there's the low
14 effect where it is more just an offensible (phonetic)
15 odor or stinging of the eye and so forth.
16 This is how, this table which I'm showing
17 here, is how the applicant has decided to, if you
18 will, determine what are high, intermediate, and low
19 consequence events, and they have identified them for
20 both the worker receptor and also the IOC/public
21 receptor. And the only difference between those two
22 is the distance to where the receptor is assumed to
23 be.
24 CHAIRMAN POWERS: Sixty meters was a
25 difference now. There's no difference at all.

1 MR. MURRAY: Yes, there's only a small
2 difference now. It used to be 100 meters versus four
3 and a half miles. Now it's 100 meters.
4 MR. ROSEN: For example, how long is the
5 longest dimension of a building?
6 MR. MURRAY: Hold on a second. I want to
7 say it's about 170 meters. Do you know, Dave,
8 offhand?
9 MR. BROWN: I don't know. I think it's a
10 little larger than that.
11 MR. ROSEN: One hundred and 70 meters. So
12 it's --
13 MR. BROWN: Or round about.
14 MR. MURRAY: Yeah, somewhere on that
15 order.
16 MR. ROSEN: So if you release something at
17 one end of the building, somebody at the other end of
18 the building --
19 CHAIRMAN POWERS: Is safer than somebody
20 at the site boundary.
21 MR. ROSEN: Right. Further away from the
22 source.
23 MR. MURRAY: Yes. Significantly, in this
24 case, the applicant has made commitments that while
25 they define high, intermediate, and low consequence

1 events by the preceding table, in actuality they are
2 going to not exceed, if you will, the Level II values,
3 TEEL-2s, ERPG-2 values for the worker receptors, and
4 not exceeding the Level I values for the public
5 receptors at 160 meters.
6 And if you can compare the two tables, you
7 notice that these are essentially one step lower.
8 Now, the staff looked at this, and again,
9 we noted and it's all discussed in the FSER that there
10 are multiple limits which are available, and one of
11 the concerns that we had was that the Level III
12 values, which the applicant had proposed, trend toward
13 the high ranges of all the limits which are out there
14 in the world.
15 Now, when you look at the Level II limits,
16 TEEL-2, ERPG-2, you find that these are significantly
17 lower than these Level III limits. They all are below
18 what are called IDLH values, immediately dangerous to
19 life and health, and there's more consistency between
20 the different limits.
21 And I point out again here the applicant's
22 commitment to workers and not exceeding a Level II
23 level and the public not being exposed to anything
24 greater than the Level I.
25 The staff review also found out that Level

1 I values tend to approximate what we call habitability
2 limits which are put out by OSHA and NIOSH. Okay?
3 And in the end we've summed this all up in several
4 tables in the FSER. We find that their approach on
5 the limits is acceptable for the construction stage.
6 MR. ROSEN: Is the habitability limit
7 something that if you were at that limit, you could
8 live there essentially forever?
9 MR. MURRAY: Essentially indefinitely.
10 Okay. If you look at the definitions, most of the
11 Level I values, be they ERPGs, TEELs, AEGLs, they all
12 are generally identified as being, oh, there's
13 noticeable odor. There might be some discomfort, but
14 there is essentially no significant effect.
15 CHAIRMAN POWERS: I thought they were for
16 an eight-hour working day.
17 MR. MURRAY: The Level I values?
18 CHAIRMAN POWERS: The habitability limits.
19 MR. MURRAY: Habitability limits --
20 CHAIRMAN POWERS: I don't think you do
21 infinite amount of time. I mean if there's any order
22 at all, you can't be there for an infinite amount of
23 time.
24 MR. MURRAY: I have to check on that,
25 Dana.

1 CHAIRMAN POWERS: I think they're for, you
2 know -- I mean, I think the idea was taking advantage
3 of basic workers are relatively healthy people and
4 have good recovery systems, all operational, and so
5 that it was for a finite period of time, but I could
6 be wrong. It has been a long time since I looked at
7 them.
8 MR. MURRAY: I have to check. I know
9 there are habitability limits out there which tend to
10 be long term, in essence, and also there are similar
11 limits out there which are work day limits, which are
12 eight-hour limits.
13 CHAIRMAN POWERS: Yeah, I just can't
14 remember which one's which.
15 MR. MURRAY: Yeah, I'd have to check for
16 you, Dana.
17 Okay, and any other questions on TEELS?
18 CHAIRMAN POWERS: The bottom line is
19 they've straightened this out and gotten it organized
20 so that it's a fairly coherent --
21 MR. MURRAY: Yes.
22 CHAIRMAN POWERS: -- and meaningful set
23 now instead of that hodgepodge that came in
24 originally.
25 MR. MURRAY: Right, right. It seems that

1 the approach is now better thought out, more
2 consistent, and the focus on, if you will, essentially
3 using lower values, a commitment to lower values is,
4 we think, a very positive step.
5 CHAIRMAN POWERS: Everybody wants lower
6 values on these things.
7 MR. MURRAY: Yes, yes, yes.
8 CHAIRMAN POWERS: The NRC and its reactor
9 domain has what, four years ago, I guess? Went
10 through this for the control rooms of the reactors and
11 looked at them.
12 MR. MURRAY: Yes.
13 CHAIRMAN POWERS: Did you do a cross-
14 comparison between the two?
15 MR. MURRAY: Yes, we did, okay, and we
16 found that sometimes the Level III limits will, if you
17 will, exceed those limits in Reg. Guide 1.78 on
18 control room habitability, and sometimes they'd be a
19 little bit below.
20 CHAIRMAN POWERS: I mean, the whole
21 situation on limits and chemicals is just a mess in
22 this country.
23 MR. MURRAY: Yes.
24 CHAIRMAN POWERS: And unfortunately NRC is
25 too small of a fish to put pressure on them to fix it.

1 MR. MURRAY: We're just a little guppy in
2 the big ocean.
3 CHAIRMAN POWERS: Yeah. And nobody wants
4 to fix it because they've got the set that they want
5 to live with, and they don't want anybody to change
6 it, and so it's a hodgepodge.
7 MR. MURRAY: And there's limited data for
8 making changes.
9 CHAIRMAN POWERS: That's also the problem.
10 MR. MURRAY: Yes. Okay. Any other
11 questions?
12 We'll discuss control room habitability a
13 little later on.
14 CHAIRMAN POWERS: Good. Any other
15 questions about -- I mean, it's an extremely
16 frustrating area because, I mean, we don't have
17 expertise in this area. You'd like to have somebody,
18 you know, like ICRP come in and lay down the law on
19 this, but as we said, there's nobody in a position to
20 do it, and NRC is just not capable of putting the
21 torque on the necessary legislators to do it, and
22 people have their own limits for their processes, and
23 they just don't want anybody to change it.
24 MR. MURRAY: Yeah.
25 CHAIRMAN POWERS: And the other problem is

1 there are more chemicals than there are limits. So
2 you end up doing strange things that you know are
3 unjustifiable because we wouldn't call them different
4 chemicals if they had all the same properties.
5 MR. MURRAY: That's right. That's right.
6 CHAIRMAN POWERS: So it's extremely
7 frustrating. But having something that hangs together
8 and makes sense is about the best you can hope for.
9 MR. MURRAY: Yes, and that's the approach
10 we've taken.
11 And, well, since we've discussed the
12 control room, here we are, discussing control room
13 habitability. And I just want to just again do a
14 quick introduction about habitability.
15 The proposed MOX facility will have
16 multiple control rooms and areas. Okay? Now, in
17 addition, the applicant has stated they will have two
18 emergency control rooms or ECRs. And I've listed the
19 two functions of those ECRs.
20 The first is to maintain a habitable
21 environment for operators, and the second is to
22 provide cooling to emergency electrical rooms.
23 MR. ROSEN: Are these emergency control
24 rooms the ones that are continuously manned or is
25 there nothing analogous to a power plant control room

1 in this facility, that is, one place that is
2 continuously manned, where individuals who are
3 competent in the whole process, keep an eye on the
4 whole everything that's going on, or is it much more
5 disbursed than that, nothing like that?
6 MR. MURRAY: Our impression, myself, other
7 reviewers, of the proposed facility is that there will
8 be more of what we call a distributed control
9 strategy, whether it be, in essence, separate control
10 rooms for specific areas of the plant, and this is
11 what the applicant has identified in their
12 application.
13 As it goes forward into final design and
14 we receive a license application, we anticipate one or
15 more of those areas or the emergency control rooms may
16 be identified as continuously manned, but at the
17 present time, if an event were to occur, the
18 appropriate operators would go to the ECRs and perform
19 their safety functions, which is monitoring a safe
20 shutdown.
21 MR. ROSEN: Well, it gives me a little bit
22 of concern, the idea that there's no one place where
23 someone or other has overall integrated responsibility
24 for the facility on a 24-7 basis. They may not be
25 doing anything in particular in terms of process-wise,

1 but they're just watching. They know what's going on.
2 This is they're operating. They're operating here.
3 They're operating on Level II, then this and that.
4 And so they know how many people roughly
5 there are in the facility and where they are and who
6 they may be. So, you know, if there's an emergency
7 they can do an accountability, get people out, know
8 who's supposed to be there, who they've gotten out,
9 who's missing and that kind of thing.
10 Any thoughts along those lines?
11 MR. MURRAY: From the staff's review of
12 the application, revised application, plus also other
13 documentation and discussions with the applicant, our
14 impression is the ECRs may end up meeting that
15 requirement.
16 But at the present time we're looking at
17 design bases. We don't have explicit information
18 on --
19 MR. SIEBER: It doesn't say that.
20 MR. MURRAY: Exactly, exactly.
21 MR. ROSEN: And you have no criteria for
22 that kind of function.
23 MR. MURRAY: If you're talking about an
24 accountability function, no. If you're talking about
25 maintaining habitability in the emergency control

1 room, we have --

2 MR. ROSEN: I'm talking about

3 accountability function, overall process control over

4 the whole facility.

5 MR. MURRAY: We would expect the details

6 of that to be in the license application. We do have

7 in the instrument area and some of the human factors

8 areas, if you will, design bases which have been

9 identified by the applicant and reviewed by the staff,

10 which, again, top level sort of approach would address

11 those sorts of questions.

12 CHAIRMAN POWERS: Well, I guess the

13 question that comes to mind is suppose you have an

14 event that exceeds your expectations. Well, maybe it

15 doesn't exceed your expectations, but it hits your low

16 probability events. Low probability events do occur.

17 MR. MURRAY: Yes.

18 CHAIRMAN POWERS: Who makes the

19 declaration of a general site emergency?

20 MR. MURRAY: That would be in a procedure,

21 and procedures will be reviewed in the license

22 application.

23 CHAIRMAN POWERS: Yeah, but who does it?

24 I mean, who's going to read this procedure and follow

25 it?

1 MR. MURRAY: I would have to look at the
2 management structure, which is discussed and evaluated
3 up front in the document. Right now I don't have an
4 answer.
5 CHAIRMAN POWERS: Yeah, but the trouble is
6 I don't think I have an answer either, and I think I
7 looked at that. I mean, I think I don't understand
8 what I read.
9 MR. MURRAY: Yeah, do you recall, Dave?
10 MR. BROWN: No, I don't recall the
11 specific title of the individual who's responsible for
12 managing emergency response at the plant in the event
13 of such an emergency.
14 They have described specific features of
15 the plant, you know, such as the safe havens. There
16 are five safe havens.
17 CHAIRMAN POWERS: Yeah, I've got all of
18 that sort of stuff.
19 MR. BROWN: Nonessential personnel will
20 escape to those areas, that sort of thing.
21 CHAIRMAN POWERS: They've got lots of
22 individual things, but who makes the decision that I
23 have a general site emergency? Who makes the phone
24 call to the NRC that says, "I've got a problem here"?
25 MR. BROWN: This is something --

1 CHAIRMAN POWERS: Who calls Savannah River
2 that "look out, F. Canyon. Here I come"?
3 MR. BROWN: The current plan, and as you
4 may have seen in the CAR in Chapter 14, is that this
5 facility will be integrated with the existing Savannah
6 River site facilities. The plan is that this will be
7 an annex to the site-wide emergency plan. So the call
8 would be to the Savannah River site in the operations
9 center.
10 CHAIRMAN POWERS: I know where it's going
11 to go.
12 MR. BROWN: But who, right? I understand.
13 CHAIRMAN POWERS: And the other thing is
14 I'm quite certain this facility will follow the well
15 established rule known since TMI, Chernobyl, et
16 cetera, that all major events occur after one o'clock
17 on Tuesday morning, call on the back shift.
18 So the question really boils down to: who
19 is this guy?
20 MR. ROSEN: Where does he sit?
21 CHAIRMAN POWERS: And how does he know
22 that he's got a general site emergency if he's in
23 Control Room 2 and Control Room 1 is where the event
24 is taking place?
25 MR. BROWN: Well, the control rooms, as

1 Alex suggested, are distributed so that there's a
2 control room for the aqueous polishing side of the
3 plant, a control room for the MOX fabrication side of
4 the plant. So there are not two trains of the normal
5 controls.
6 CHAIRMAN POWERS: No, no, no. That's not
7 what I'm implying. I'm implying that the guy that's
8 familiar with aqueous polishing knows when he's
9 getting into trouble.
10 MR. BROWN: That shift supervisor, right?
11 CHAIRMAN POWERS: He may not understand
12 when he's getting in trouble when he has a metal fire
13 going on over in the fuel fab site.
14 MR. BROWN: Oh, okay.
15 CHAIRMAN POWERS: And vice versa, and so
16 the guy in the aqueous polishing may not be the guy
17 that is the right guy to make the call about a general
18 site emergency because you're burning fuel. I mean,
19 I don't know. Maybe he is. Maybe this is Mr.
20 Wonderful here, but aqueous chemists tend not to be
21 terribly familiar with condensed phased reactions and
22 vice versa.
23 MR. BROWN: Right.
24 MR. MURRAY: Unless you've been burned by
25 both.

1 CHAIRMAN POWERS: Unless you've been
2 burned by both, exactly.
3 MR. ROSEN: So in which case you're
4 promoted to being the guy who we look to.
5 CHAIRMAN POWERS: You're the guy that
6 we're looking for, is the guy that has holes in both
7 sides of his jeans.
8 MR. MURRAY: Yes, I don't think from our
9 review of the application we have a specific, if you
10 will, title or position identified.
11 MR. ROSEN: You understand, Alex, that in
12 reactor operations, just by comparison, you've got
13 one, two, three, probably four levels of control that
14 are established, and the transfer of control from the
15 main control room during operation through these other
16 levels of control is a very choreographed protocol
17 operation.
18 MR. MURRAY: Yes, yes.
19 MR. ROSEN: And there's a great deal of
20 detail, and what we find here is we don't even know
21 where the control room is. I find that rather
22 astonishing.
23 MR. MURRAY: Well, I think what we have
24 run into is one of the artifacts of the two-step
25 licensing. You know, top level design basis

1 information now, detailed procedures, identification
2 of positions for calling or starting these emergency
3 actions would be defined in the license application,
4 but we can go back and take a look.
5 MR. BROWN: That's exactly right. The
6 focus now is on system structures and components to
7 make sure that the systems that would alert operators
8 of that condition are there, but we don't have
9 detailed information on the plant procedures,
10 including emergency procedures.
11 CHAIRMAN POWERS: You know, you can make
12 this two-step system the last refuge of the scoundrel
13 here. I mean this sounds like it's fairly fundament
14 to me.
15 MR. BROWN: To the structures? I don't
16 think so.
17 CHAIRMAN POWERS: I mean, to the overall
18 design is understanding who's in charge when.
19 DR. WEINER: Well, shouldn't there be one
20 focal point where there is someone, some personnel
21 that have an overview of the entire process? This is
22 a flow. This is a chemical flow process, and to have
23 separate control rooms with no centralized at least
24 overview, from my naive point of view, that's a
25 structural problem, isn't it?

1 I mean, there has to be some design that
2 looks at all of the control systems.
3 MR. BROWN: The two parts of the plant are
4 essentially separate, and they run in a batch mode.
5 So there's not really as much interaction there, I
6 think, as the question suggests. The one person is
7 concerned with plutonium purification in the aqueous
8 polishing step who provides canisters that go into
9 storage, and when those canisters are required to
10 produce MOX fuel, they are pulled out of storage for
11 that purpose.
12 So there's a clear break in the
13 operational process there, and there really are almost
14 distinct structures of the same building.
15 MR. SIEBER: It seemed to me that the
16 whole process was a batch kind of process with a lot
17 of little work stations and gloveboxes, not connected
18 together except through the ventilation system, you
19 know, and so each one of these would operate
20 independent of all the --
21 CHAIRMAN POWERS: That's a non-trivial
22 connection.
23 DR. WEINER: Yes.
24 MR. SIEBER: Yeah. Well, it serves a
25 single function. Okay? So an accident in one portion

1 of the plant affects all other portions because it's
2 connected to the same internal environment.
3 On the other hand, this piece of equipment
4 is not necessarily dependent on the operation of
5 another process piece of equipment. It is not a
6 process industry. It's all batches.
7 MR. MURRAY: Yes. The process is what we
8 call essentially a semi-batch process, and we do have
9 a lot of intermediate storage locations both in the
10 aqueous polishing side and in the mixed oxide powder
11 side.
12 Now, I think we'd have to go and take a
13 look at Chapter 1 of the draft FSER to check out to
14 see where the administrative structure would fit in
15 here, and offhand I don't recall, to be quite honest.
16 CHAIRMAN POWERS: Yeah, we could get
17 there, but I just don't understand what I'm reading,
18 I guess.
19 MR. MURRAY: We can get back to you on
20 that one.
21 MR. ROSEN: Well, I think we're making a
22 list of things we kind of want to know more about, and
23 it might be some of these things will make it into a
24 letter so that you'll have something that reminds you.
25 MR. MURRAY: Okay.

1 MR. SIEBER: It seems to me there was
2 no -- there's a fair amount of description of the
3 organization when they're building the plant, the
4 design part and the construction part, but there's not
5 a lot of description about the operating part of it.
6 CHAIRMAN POWERS: That's not terribly
7 surprising.
8 MR. MURRAY: Again, that's because of the
9 two-step licensing process.
10 MR. SIEBER: Right. So I think if you
11 hunt through what we already have, you're going to
12 spend a lot of time and not find any.
13 MR. ROSEN: The question remember came up
14 because we're talking about two emergency control
15 rooms. We're talking about functions in spaces, and
16 I think I know of a function, but I don't know which
17 space it goes into.
18 MR. MURRAY: Okay. We'll have to check
19 and get back to you.
20 Let me continue on here. Okay. I'm just
21 going to briefly discuss the emergency control room
22 ventilation system or just simply ECR HVAC, and I've
23 noted here some of the parameters. Each system
24 consists of two 100 percent capacity filter trains,
25 one per ECR. Each train has one intake, and in that

1 train a filtration unit and a booster fan.

2 In addition, the filter unit includes, in

3 addition to HEPAs, a Haslet (phonetic) gas removal

4 cartridge and/or a cartridge for removing volatile

5 organics.

6 Now, here is the safety issue. From the

7 staff's review, we noted that several chemicals on

8 site could affect habitability, and some are present

9 as liquids and some are essentially a liquid-gas

10 mixture.

11 And releases of these chemicals could

12 prevent the ECR operators from performing their safety

13 functions.

14 Now, the applicant has realized this, and

15 they have a safety approach. I've identified it here.

16 They have decided that there will be, if you will, an

17 ECR HVAC system, and as I've shown here in the initial

18 application, we have the PSSC, but not a design basis,

19 and in the FSER we have imposed a proposed permit

20 condition which requires a habitable design basis.

21 Now, these are the actual controls that

22 the applicant has proposed. The ventilation system

23 for each ECR is identified as a PSSC. Elicit that

24 safety function, which is to maintain habitability,

25 and the design bases, which are used and are listed in

1 the table and the FSER. IDLHs from Reg. Guide 1.78
2 and OSHA. Level II values, which are from Table 8-5
3 of the CAR, and Level III values if they are less than
4 the IDLH. This is what the applicant has proposed.
5 And I've also listed some other aspects of
6 the applicant's approach here, and again, it seems to
7 be a thought through from a functional perspective.
8 You know, if you detect a hazardous chemical above
9 allowable limits, that intake is isolated and
10 switched to recirc. mode. If it has these chemicals
11 at both intakes to the two -- there's one intake per
12 ECR -- then the alarm sounds, and both ECRs go into
13 recirc mode, and the operators are to don scubas.
14 And I just listed something a little bit
15 more about the monitoring and the applicant has stated
16 they will have a monitoring system for those chemicals
17 which they think in a release could result in
18 exceeding control room limits.
19 CHAIRMAN POWERS: Will they monitor
20 oxygen?
21 MR. MURRAY: There is a separate slide
22 that I'll get to in a moment about potential
23 asphyxiation. Okay? They have stated as a design
24 basis, which applies to oxygen content, and they will
25 do detailed analyses in the license application to

1 address that, but that's about two slides further on.
2 These emergency actions, i.e., going into recirc mode
3 as an example, will be initiated when the chemical
4 concentrations are at or below the TEEL-3 limit in
5 essence, and any specific set points would be
6 determined in the license application.
7 And this, I guess, was the next slide, not
8 two slides down. This is the design approach that the
9 applicant intends to use to address potential
10 asphyxiation concerns. Again, they will do analyses
11 of individual rooms, and if that analysis shows that
12 they need to have oxygen monitors or some form of
13 habitable air monitors in that area, they will put
14 those in as required.
15 And for high asphyxiating or to avoid
16 asphyxiating atmospheres, they expect the high
17 ventilation rates will preclude the formation of, if
18 you will, an asphyxiating atmosphere.
19 And they do list this publication from the
20 CGA, which has to do with oxygen/air quality.
21 Does that address your question?
22 CHAIRMAN POWERS: Yeah. I mean that's
23 explicitly exactly what they should be doing. I mean,
24 with all of that nitrogen that you're using and the
25 system asphyxiation --

1 MR. MURRAY: Is a concern, yes, yes.

2 MR. ROSEN: Well, argon as well.

3 MR. MURRAY: Yes.

4 CHAIRMAN POWERS: Argon especially.

5 MR. ROSEN: Especially.

6 MR. MURRAY: Yeah, we'll touch on this a

7 little more later on. Okay?

8 Now, staff has evaluated this, okay, and

9 we noted we have a safety function for the emergency

10 control room operators. They have a safety function

11 to maintain habitability in these emergency control

12 rooms, and we did look at the values which they had

13 proposed, and we noticed that these values are not

14 consistent with habitable conditions. All right?

15 They tend to be Level III or in some cases

16 IDLH values. So what we concluded was the Level I

17 values, which we were discussing a moment ago,

18 approximate habitable conditions, and because of that

19 the staff is proposing a permanent condition which

20 will state that an additional function of the ECR HVAC

21 system is to maintain chemical concentrations below

22 Level I values for the duration of the event.

23 Okay? And the staff has concluded as

24 stated in the draft FSER that both the safety approach

25 and the permanent condition should provide adequate

1 assurances of safety.

2 CHAIRMAN POWERS: Because I don't quite

3 understand. It seems like we're coming back and

4 saying, "Look. Putting IDLH values or even anything

5 that's close to it is not really what I want my design

6 basis for my HVAC system to be."

7 And so you're saying your design basis

8 should be something like Level I.

9 MR. MURRAY: Yes.

10 CHAIRMAN POWERS: Well, that's great. Has

11 the applicant said, "Oh, yeah. Sorry about that.

12 You're right"?

13 MR. MURRAY: Do you have any feedback,

14 Dave?

15 MR. BROWN: At this point, we're

16 discussing it. We have not had a meeting to discuss

17 this one.

18 CHAIRMAN POWERS: So there's a clear

19 difference between your position and the applicant's

20 position here.

21 MR. BROWN: Yes, there is.

22 CHAIRMAN POWERS: Why isn't this an open

23 item?

24 MR. BROWN: At this point, you know, we

25 have several options with this kind of review. We

1 have approved the applicant's proposal. We approve it
2 with conditions or we deny it, and of course, this is
3 an approval with condition.
4 An open item is something we would carry
5 in, say, a draft SER leading up to a final conclusion,
6 but this is our final conclusion.
7 CHAIRMAN POWERS: It seems to me there's
8 a compromise position, which is not uncommonly
9 adopted, and that is that your design basis is to
10 assure once concentrations from the available sources
11 exceed the IDLH, you have 30 minutes within the
12 control room in order to take some action, which often
13 involves donning scuba gear and trying to operate the
14 facility, which obviously is a plan designed by
15 someone who never tried to operate a facility in scuba
16 gear. But, I mean, it's not uncommon to adopt that.
17 There are compromise positions in here to
18 achieve the same safety function. Can you walk away
19 from this facility?
20 MR. MURRAY: I'm sorry?
21 CHAIRMAN POWERS: Can you walk away from
22 this facility if you shut it down? Can you walk away?
23 MR. BROWN: No, not immediately. What do
24 you mean by that though? I'm interpreting that as
25 having --

1 CHAIRMAN POWERS: I do a finite number of
2 shutdown stuff. Can I walk away from the facility?
3 MR. BROWN: Right. The design is intended
4 to be such that it will bring itself to safe shutdown
5 condition automatically.
6 CHAIRMAN POWERS: And I can just take a
7 hike at that point.
8 MR. BROWN: Right.
9 MR. SIEBER: Well, it wouldn't be as leak
10 tight as if the actions like ventilation were
11 functional. But you don't have decay heat or anything
12 like that to attend to.
13 MR. BROWN: But I did not interpret that
14 question literally, which is that we could walk away
15 and leave the building vacant and shut down.
16 For example, the ventilation system is
17 designed, especially the C4 confinement system, will
18 be always operable, never shut down.
19 MR. SIEBER: Right.
20 CHAIRMAN POWERS: Yeah. I mean, I think
21 what I meant by that was, yeah, the ventilation system
22 is working. It just doesn't need me there, and I can
23 go away for some protracted period of time measured in
24 days but not in weeks and think about it and then come
25 back and handle that, and you're saying, yeah, that

1 would be fine.

2 MR. BROWN: You could do that.

3 CHAIRMAN POWERS: That's good. I mean,

4 that's a good way to design these things.

5 MR. MURRAY: Yeah, an automated system,

6 automated plant.

7 MR. MAGRUDER: This is Stu Magruder from

8 the staff.

9 I just want to jump in and try to get to

10 your question about potential compromise on this

11 issue. I guess for various reasons there has not been

12 as much dialogue on this issue as there probably

13 should have been, and now that the applicant has had

14 a chance to look at the SER or the draft SER, we're

15 starting up discussions on this. There's a potential

16 that we could publish the final SER without this

17 condition. I mean it would be our goal actually not

18 to have any conditions in the --

19 CHAIRMAN POWERS: And you understand my

20 problem, if I take in front of Chairman Wallis a

21 proposed position and he says, "Oh, but the SER

22 doesn't have anything to do with this statement right

23 here," he's not going to be gracious in his comments.

24 DR. WALLIS: I'm always gracious.

25 MR. MAGRUDER: I understand.

1 CHAIRMAN POWERS: I encourage you to go on
2 and discuss these things, but do let us know if
3 anything changes because I like to stay in Mr. Wallis'
4 good graces. He is not kind when he think you've done
5 him wrong.
6 MR. MAGRUDER: No, we definitely intend to
7 keep you informed. We've discussed --
8 CHAIRMAN POWERS: He tends to compare you
9 to his sophomores.
10 DR. WALLIS: Or worse.
11 MR. MAGRUDER: We will get the errata to
12 the SER staff with exactly what's going on.
13 CHAIRMAN POWERS: I encourage you to go
14 ahead and discuss this because I think there's lots of
15 room in it, and we had exactly this problem on control
16 room habitability, is the initial proposal was, oh,
17 well, let's just use these IDLHs, and then we regaled
18 the presenter with stories about trying to put on
19 scuba in 500 ppm amonia and ask him if he would like
20 to do that and show us how that worked.
21 It does not work well.
22 MR. SIEBER: I'd like to go back to Dr.
23 Powers' question just for a second about walking away
24 from the plant. My impression is that you can't just
25 decide on the spur of the moment that you're going to

1 walk away if you have processes, batches in operation,
2 for example, in order to protect a solvent extraction
3 process. You have to deal with the chemicals that are
4 there so that you don't end up with explosive mixtures
5 and so forth before you decide to take a hike, before
6 you walk away.
7 So you can't decide on the spur of the
8 moment, you know, we've ha a seismic event or
9 something else happened on the Savannah River site and
10 we want to leave. You just can't leave at that point
11 in time without finishing certain steps that are
12 involved in certain of these batch processes, and then
13 you can walk away.
14 And I think that is a more complete answer
15 at least in my mind than to say, yes, you can walk
16 away because you can't at any time. You have to, you
17 know, do some things before you leave; is that
18 correct?
19 MR. MURRAY: I agree with you, and from
20 our review of the revised application and other
21 correspondence on the docket, that it our
22 interpretation of what the applicant is proposing.
23 That's why there are two emergency control rooms.
24 That's why they want to maintain habitability, because
25 they'll be operators in those control rooms performing

1 safety functions, monitoring, slash, shutdown, safe
2 shutdown of the facility.
3 MR. SIEBER: Yeah, and in the licensee's
4 application, there is a discussion pretty far back in
5 the application of the emergency plan. They do have
6 an emergency plan. So it's there.
7 Okay. Thank you.
8 MR. MURRAY: Oh, you're welcome.
9 Any other questions on control room
10 habitability?
11 CHAIRMAN POWERS: Have we got control room
12 habitability covered adequately?
13 (No response.)
14 CHAIRMAN POWERS: Alex, you've going to
15 get a gold star from us here. You're getting way
16 ahead of time. I mean, I think these guys took -- you
17 must have fed them something for lunch. I don't know.
18 MR. SIEBER: Or we're groggy.
19 CHAIRMAN POWERS: Is Rex available to talk
20 to us? I propose that we go right on to his
21 discussion rather than taking a break.
22 PARTICIPANT: Aw.
23 CHAIRMAN POWERS: You just got out of
24 lunch, and you ate too damned much there anyway. It's
25 making you sleepy, and you've giving Alex a bye here,

1 and he's going to go home and say how disappointed he
2 was because he didn't get interrogated enough at the
3 ACRS to hardly make it worth his while.
4 (Laughter.)
5 CHAIRMAN POWERS: Thank, Alex. That was
6 a good briefing.
7 MR. SIEBER: Thank you.
8 MR. MURRAY: Thank you.
9 MR. WESCOTT: Okay. I guess I'm the slide
10 controller here.
11 Okay. Good afternoon. My name is Rex
12 Wescott. I'm a senior fire protection engineer and
13 was the ISA coordinator for the MOX CAR review.
14 I'm here this afternoon to talk about the
15 flammability issue. Basically four open items reflect
16 the need for flammability control. One of the items,
17 open items, was CS-09, which is the design basis of
18 various solvent combinations and process vessels; AP-
19 02, hydrogen generation in the electrolyzers; AP-08,
20 off-gas unit flammable gases; and AP-09, which is the
21 off-gas unit solvent flammability.
22 Flammable and combustible materials can
23 initiate fires and explosions. They can initiate
24 flash fires, combinations just above the lower
25 flammability limit or at the lower flammability limit.

1 They can result in deflagrations as the concentrations
2 get somewhat higher, and they can result in
3 denotations in some cases when you start getting near
4 the stoichiometric mixture of flammable gases and air.
5 CHAIRMAN POWERS: You fire protection guys
6 can't put up a viewgraph without a triangle on it; is
7 that --
8 (Laughter.)
9 MR. WESCOTT: Well, I've got something,
10 but I'd rather wait until I get to the end of the
11 presentation because if I start messing with it here,
12 I don't know what's going to happen.
13 CHAIRMAN POWERS: I've just got to harass
14 the fire protection guys.
15 MR. WESCOTT: All right.
16 CHAIRMAN POWERS: Well, fire protection
17 always begins with a triangle. It says you've got to
18 have fuel, heat source, and oxidant.
19 DR. WALLIS: Is that what it means?
20 CHAIRMAN POWERS: And so I think they're
21 congenitally required to have triangles on their
22 slides.
23 MR. WESCOTT: Well, actually it's being
24 taught as a trapezoid now. You have to have that
25 other part, which is basically close enough

1 combination so that you can get a continuous chain
2 reaction with the fuel.
3 CHAIRMAN POWERS: Oh, you guys,
4 anachronistic. You guys are getting too
5 sophisticated.
6 MR. WESCOTT: Okay. The applicant
7 proposed a preventive strategy and adopted NFPA-69.
8 This is the design basis, and NFPA-69 is the NFPA code
9 for explosion prevention.
10 Six areas of applicability were identified
11 where you wanted to apply NPFA-69, and these are the
12 solvent recovery area, the oxalic precipitation and
13 mother liquor units, high temperature acid recovery,
14 that is, high temperature equipment in the acid
15 recovery area, low temperature equipment in the acid
16 recovery, hydrogen from radiolysis, radiolysis like in
17 the waste area, and the electrolyzer units, were the
18 six areas where NFPA-69 criteria was to be proposed.
19 And also the sintering furnace was another
20 area, but we had already accepted that for maintaining
21 25 percent -- well, that wasn't one of the open issues
22 that was discussed last time.
23 CHAIRMAN POWERS: Do I understand why 25
24 percent of LFL? I mean, why not delta below LFL?
25 MR. WESCOTT: Yeah. Well, actually in

1 some areas it is even more. I think an underground
2 fuel storage tanks, I think they go down even lower
3 than 25 percent LFL.
4 I was never on one of the code committees,
5 but what often these are, they're not arbitrary, but
6 what they are is they're numbers that seem to present
7 a safe margin and at the same time are doable. It's
8 kind of reached by consensus.
9 CHAIRMAN POWERS: I mean, the rational
10 that was adopted for the Hanford tanks, for instance,
11 was how fast could a rise in combustible gas be, and
12 how did that compare to your ability to detect it.
13 MR. WESCOTT: Right, exactly.
14 CHAIRMAN POWERS: And you know, after some
15 machinations and whatnot, they said, "Well, if we were
16 at 25 percent of LFL, sure enough, we could probably
17 detect it before we exceeded it," for most of the
18 events that they knew about.
19 And the one that they couldn't do that on,
20 they remediated the tank. Now, that was a fairly
21 rationale picking of 25 percent of LFL, but other
22 places who adopt this number I never understand
23 because delta before LFL is fine. You aren't going to
24 propagate, and usually those LFLs are for an upward
25 propagating combustion event, not for a downward

1 propagating combustion event.

2 MR. WESCOTT: I think one thing that has

3 to be said about our review process here is basically

4 because the design wasn't completed, there's a lot of

5 information that still hadn't been developed. We sort

6 of set code compliance as probably one of the major

7 hurdles for the CAR review. Now, when we get into the

8 actual ISA review, I think we're going to start

9 looking at things like generation rates of hydrogen,

10 what actually happens to combustible solvents. Do we

11 really have problem? Is 25 percent safe?

12 I mean there's different ways of

13 controlling it. We have a rapid generation of gas.

14 Maybe the off-gas system could be designed to

15 continually provide a high flow of air. You know, we

16 didn't want to try to dictate design at this point

17 because we're not at the design --

18 CHAIRMAN POWERS: So presumably we could

19 find it going both ways, that if you were not getting

20 a great deal of safety benefit from being a 25 percent

21 LFL, but getting a lot of operational headache, you

22 could move it up.

23 MR. WESCOTT: That's correct.

24 CHAIRMAN POWERS: And if you found out

25 that your detector response was slow to the generation

1 rate, you might move it down.

2 MR. WESCOTT: That's correct, or you might

3 worry about the off-gas system as a whole so that the

4 generation in the vessel -- you have a number of

5 options probably to go at.

6 CHAIRMAN POWERS: Now here you get to my

7 ignorance barrier. I know that when we burn hydrogen

8 at near the LFL in any kind of volume at all that you

9 get the most incomplete burn you ever saw in your

10 life. I mean, you're lucky if you get a third of the

11 hydrogen to combust at those levels.

12 MR. WESCOTT: Yeah, it depends on how well

13 mixed it is. If it's just --

14 CHAIRMAN POWERS: You could put a --

15 MR. WESCOTT: It's very inefficient.

16 CHAIRMAN POWERS: You can put a whirling

17 dervish in there, and you just can't get a complete

18 combustion, but I don't know that that's the case for

19 some of these organics because I don't know what their

20 LFLs are, to begin with. And I don't know whether

21 they're more complete in their combustion at down near

22 the level.

23 MR. WESCOTT: Well, you know, I think one

24 rule of thumb is that you get more complete combustion

25 as you get closer to stoichiometric levels because if

1 you're not at the stoichiometric level, of course,
2 you've got a lot of extra gas in there that's not
3 taking part in the combustion, just keeping the
4 molecules away from one another.
5 So I think, you know, the farther you are
6 away from the stoichiometric mixture I guess the less
7 complete your combustion, but as far as LFLs, there's
8 no real good rule of thumb. I used to think hydrogen
9 had a relatively low LFL, but then you look at
10 something like acetylene, which is even lower.
11 Propane is lower. A number of gases are lower LFLs,
12 you know.
13 CHAIRMAN POWERS: Acetylene is down like
14 about one percent or something like that. I think one
15 percent, something like that?
16 MR. WESCOTT: For what gas?
17 CHAIRMAN POWERS: Acetylene.
18 MR. WESCOTT: Yeah. I didn't know it was
19 that low, but it's probably close, and of course you
20 could almost have 100 percent atmosphere with
21 acetylene and still get combustion. You know, you
22 don't need much air in there.
23 CHAIRMAN POWERS: You don't need much air,
24 but in general things are around three or four
25 percent, aren't they, like butane?

1 MR. WESCOTT: Yeah, I think they probably
2 range from two to five to six, something like that.
3 MR. MURRAY: So a low of about two, high
4 of about seven of LFL.
5 MR. WESCOTT: Yeah, yeah. Okay. Oh,
6 yeah. Moving on past 16, we also reviewed some other
7 guidance we looked at, too. We looked at NFPA-30,
8 which is combustible liquids codes because solvents
9 really kind of come under combustible liquids as
10 opposed to flammable gases.
11 We looked at our NUREG 1718, our SRP. We
12 looked at the Hanford tanks and what was done there.
13 So we took into account a number of things to come to
14 our conclusions as to what to do and what would be
15 acceptable to us, and we also looked at electrolysis
16 and what were the factors that go into generating
17 hydrogen through electrolysis.
18 NFPA-69 was the main standard that we
19 looked at. That was, of course, the standard
20 explosion prevention systems. It provides guidance on
21 oxidation reduction and concentration reduction,
22 suppression of deflagrations, for example, containment
23 of deflagrations, and you know, spark detection and
24 extinguishing. It provides a number of ways of
25 preventing controlling explosions.

1 What we are primarily interested in and
2 also the applicant is primarily interested in was
3 control of the concentration of the combustible or
4 flammable gas. That's probably the most
5 straightforward way of controlling or preventing
6 explosion.
7 CHAIRMAN POWERS: How big is the gap
8 between the flammability limits and the detonation
9 limits on these organic gases?
10 MR. WESCOTT: Like I said, it differs.
11 You get a detonation of hydrogen below the
12 stoichiometric limits and detonations require some
13 turbulence. So if you have a turbulent atmosphere,
14 you're more likely to get a detonation than if you
15 have a non-turbulent type of atmosphere that your gas
16 is in.
17 So I think there's a number of factors
18 that determine whether you're going to get a
19 deflagration versus a detonation, but probably one of
20 the biggest factors is concentration. You're not
21 going to get a detonation, say, at LFL or just, you
22 know, slightly above.
23 CHAIRMAN POWERS: Hydrogen I'm acutely
24 familiar with, but I don't have any familiarity with
25 things like butane and butanol and things like that

1 about, you know, where the relative displacement
2 between flammability and detonation limits are.
3 MR. WESCOTT: Yeah. To be honest with
4 you, the only time I've basically worked with those is
5 looking at favor cloud explosions, and you always
6 assume a detonation because that's the worst case.
7 Now, I know that, you know, some cases,
8 some areas are more prone to detonation than others,
9 but as far as being very aware of experiments where
10 they've actually tried to look at all of the different
11 parameters, I'm just not aware of that.
12 Some of the basic considerations if you're
13 going to get into the concentration reduction that you
14 have to look at is first to determine how much you
15 want to reduce your concentration, whether you're
16 going to shoot for 60 percent or 25 percent or 50
17 percent. You've got to look at variations in process,
18 temperature, pressure, and materials, all of which can
19 affect the generation rate of hydrogen.
20 Your operating controls, and you have to
21 have a maintenance inspection and testing program if
22 the kind of controls you're going to put on the system
23 are going to be reliable and maintainable.
24 Okay. Now, the MOX standard review plan
25 also has guidance in regard to explosion control.

1 Chapter 7, which deals with fire, mentions a number of
2 codes and standards to use, such as NFPA-70, which is
3 the national electric code; NFPA-69 and NFPA-30; a
4 number of codes that I haven't listed dealing with
5 oxygen systems and hydrogen tanks and systems and so
6 on, but there's a number of codes which all should be
7 looked at to have a good explosion prevention program
8 at your plant.
9 Chapter 8 also mentions specific
10 interactions which can cause problems like radiolysis
11 and degradation of organics in high radiation fields,
12 and also requires you to analyze --
13 CHAIRMAN POWERS: What kind of dose rates
14 are we going to get?
15 MR. WESCOTT: Well, if you're talking
16 about americium, which is primarily an alpha producer,
17 you're not going to get any dose outside of the
18 vessel, but you are going to get all of the energy
19 contained inside the vessel. I guess you have a high
20 G factor for generating hydrogen, and you're going to
21 get relatively efficient generation of hydrogen, but
22 I wouldn't expect any dose outside the --
23 CHAIRMAN POWERS: So the G factor for
24 hydrogen production in water is what, .45?
25 MR. WESCOTT: I'll turn to Alex for that.

1 MR. MURRAY: It depends on the source and
2 the chemical environment. I think there have been
3 some values which have been -- let me speak into the
4 microphone.
5 It depends on the environment, what's in
6 solution, and nitrates do tend to suppress hydrogen
7 evolution a bit. I keep wanting to say though some
8 values which can be higher than that, but I'd have to
9 go back and check.
10 CHAIRMAN POWERS: And then how does it go
11 with kerosene?
12 MR. MURRAY: I'm sorry?
13 CHAIRMAN POWERS: What's the G value for
14 hydrogen production in kerosene?
15 MR. MURRAY: I don't think we have a clear
16 G value for that. There has been some very good work
17 on G values done and reported in the past year or 18
18 months, and basically they were coming up with lower
19 G values than have been historically applied.
20 CHAIRMAN POWERS: My impression is the G
21 value for hydrogen in organic liquids is low, relative
22 to water, but if you asked me to prove that with
23 numbers, I'd be hard pressed.
24 MR. MURRAY: I'd have to go and look at
25 the specific data, and I don't have it on the tip of

1 my hand right now.

2 MR. WESCOTT: Okay. These are

3 recommendations on hydrogen supply. They come out of

4 the NRC SRP guidance.

5 CHAIRMAN POWERS: Hydrogen has to be

6 supplied?

7 MR. WESCOTT: For the sintering furnace,

8 for example.

9 CHAIRMAN POWERS: Yeah, but I mean, they

10 come in and they mix it with argon and they're not

11 just giving the hydrogen argon?

12 MR. WESCOTT: That's correct. It's 95

13 percent argon, five percent hydrogen or -- yeah, five

14 percent hydrogen.

15 CHAIRMAN POWERS: But, I mean, they're

16 going to do the mixing on site. They're not going to

17 -- just by the mixture.

18 MR. WESCOTT: That's my understanding.

19 Alex, do you know any more about that, that it would

20 be mixed down?

21 MR. MURRAY: For the most part, they will

22 be mixing the gases in what they call the gas storage

23 area of the proposed facility. All right? They have

24 a back-up supply of a cylinder mixture of hydrogen and

25 argon that's essentially ready mix, and they also have

1 a back-up supply of argon.

2 Okay. The hydrogen itself comes from

3 cylinders, I guess, truck mounted cylinders. The

4 argon comes from cryogenic storage.

5 And the concept, approach, if you will, of

6 the applicant is if they go outside the ranges of the

7 hydrogen limit from the pre-mixing operations, they

8 will switch to the cylinder storage. If for any

9 reason that isn't working or they have a flammability

10 concern, they will switch over to pure argon going to

11 the sintering fences.

12 CHAIRMAN POWERS: It would be interesting

13 to see the trade studies because in every case that I

14 have encountered on this, it was way easier and

15 cheaper just to go ahead and buy the gas mixture, the

16 argon-hydrogen mixture that was below the LFL than it

17 was to go through the agony of showing that you never

18 got above the LFL and/or your mixing and manipulations

19 and things like that. I mean it wasn't even close

20 because when your source gas is below the LFL, there's

21 not too many ways to ever get yourself above the LFL.

22 It would be an interesting trade study to

23 look at on this one, not that it's pertinent to our

24 business.

25 MR. MURRAY: It's interesting.

1 CHAIRMAN POWERS: It's interesting, yeah.

2 MR. WESCOTT: If you don't mind I'd like

3 to skip to the last point on the next slide, which

4 basically just shows that the SRP really recommends

5 maintaining hydrogen below 25 percent LFL and all,

6 basically whenever possible. That was one of our

7 recommendations.

8 DR. WALLIS: Could you review what you've

9 been doing here for me? Have you been looking at

10 normal operation and concentrations of things in

11 various reactors or something or are you looking at

12 accidents? I don't see any mention of any inadvertent

13 mixing of flammable things with oxidants or anything.

14 What is this guidance applied to?

15 MR. WESCOTT: Well, I think our primary

16 concern about where we might get combustion is in the

17 off-gas system, when actually this gas is coming out

18 of the process vessels.

19 DR. WALLIS: So you are mixing it.

20 MR. WESCOTT: Mixed with air, and there

21 conceivably could be an ignition source, although

22 certainly everything will be done to prevent --

23 DR. WALLIS: Is that just a flare? It

24 just goes up in the air?

25 MR. WESCOTT: Well, it depends on, of

1 course, where the combustion takes place, and I think
2 probably your worst case is probably a flash fire
3 inside the system.
4 DR. WALLIS: Have you been look at off-
5 design conditions or something?
6 MR. WESCOTT: Well, I think we're going to
7 expect that to be done in the ISA stage.
8 DR. WALLIS: So some other stage.
9 Everything is always at some other stage.
10 MR. WESCOTT: Well, this, of course, is
11 kind of a conceptual design at this place, and we're
12 actually more interested in strategies and the design
13 bases for these strategies as opposed to actual, you
14 know, final design parameters.
15 DR. WALLIS: There must be monitoring
16 throughout the whole facility that you haven't got
17 leaks of combustibles and all of that. That's not
18 part of this at this stage?
19 MR. WESCOTT: Well, you know, one of the
20 things I should have said on the first slide is we
21 very carefully said flammable gases and combustible
22 liquids. To our knowledge, there are no flammable
23 liquids actually in the processes, you might have some
24 in the laboratory, you know, things like alcohol and
25 acetone and things like that, but your primarily

1 process liquids are combustible. They're not
2 flammable, and by that I mean that you don't have a
3 flammable vapor generation until you get up over 100
4 degrees Fahrenheit.
5 So leaks of the liquids themselves at non-
6 elevated temperatures really don't present a fire
7 hazard as such. So I think that's a point that needs
8 to be made because that's a good question. If we're
9 dealing with flammable liquids, we would have concerns
10 about leaks and things outside of these particular
11 areas.
12 CHAIRMAN POWERS: I'm struggling a little
13 bit on that.
14 MR. WESCOTT: Sure.
15 CHAIRMAN POWERS: I mean, I understand
16 what you're arguing with. You're arguing that
17 dodecane just doesn't produce enough vapor to amount
18 to anything at modest temperatures.
19 MR. WESCOTT: Right.
20 CHAIRMAN POWERS: But what you've got is
21 dodecane with tributyl phosphate in it, which is
22 rapidly becoming dibutyl phosphate and putting a
23 little butanol into the system.
24 Now, butanol does have vapor pressure.
25 MR. WESCOTT: I'm not sure of the

1 chemistry. Alex, do you know the flash points of
2 change with the combinations?
3 MR. MURRAY: The applicant has identified
4 flash points for the diluent, the TBP, and the mixture
5 of the diluent and TBP. Okay? For the diluent
6 itself, it's approximately 55 or so degrees
7 centigrade. For the mixture it's approximately 57
8 degrees centigrade, and for tributyl phosphate, it was
9 quite a bit higher. I forget the exact value.
10 CHAIRMAN POWERS: Yeah, but if I take this
11 stuff and I bang it around, heat it, throw a few alpha
12 particles through it, now I've got a much more
13 complicated mixture.
14 MR. MURRAY: That's right.
15 CHAIRMAN POWERS: And in particular, it
16 has butanol in it, unavoidably has butanol in it.
17 MR. MURRAY: Right, right.
18 CHAIRMAN POWERS: It may have some other
19 various zoology of organics of small chain link in it.
20 Now it has vapor pressure, significant vapor pressure
21 at room temperature. You can smell it.
22 MR. WESCOTT: Yes, I agree.
23 CHAIRMAN POWERS: Now what's the flash
24 point?
25 MR. WESCOTT: Well, that's why we're

1 looking at design bases. Are the design bases
2 appropriate? NFPA-69 does give you some top level, if
3 you will, design basis type guidance as to what would
4 be reasonable, what would be general practice, if you
5 will.
6 Maintaining vapor concentrations below 25
7 percent of their respective LFL is a design basis.
8 Now, depending on what the mixture is at the plant, at
9 the license application stage, the applicant will have
10 to demonstrate that under all circumstances they meet
11 the NFPA-69, which they've used as the design basis.
12 CHAIRMAN POWERS: But what I'm struggling
13 with is if you tell me to keep the vapor concentration
14 of dodecane below 25 percent of its LFL, I'm a real
15 happy camper because it's going to be damned difficult
16 for me to get it up to the LFL.
17 Okay. If you tell me to do the same thing
18 with butanol, I have got a problem.
19 MR. WESCOTT: Yeah, one of the things that
20 that NFPA-69 requires that you have to do is that you
21 really -- and this is another reason why I think we
22 want to wait until the design stage. You really have
23 to know the partial pressures of all your different
24 gases and your environment, and once you know the
25 partial pressures, you can take a ratio of the partial

1 pressure to the LFL for all of these gases and add
2 them up and they become the divider to the total
3 pressure that you have. It's a Le Chatlier's Law.
4 And that's how you determine the LFL of
5 your mixture, but until you know these partial
6 pressures, there's really no way to calculate it.
7 CHAIRMAN POWERS: Yeah, I don't know about
8 hydrogenated propylene tetramer, but I do know about
9 dodecane butanol mixtures have been investigated for
10 their non-ideality because it was one of the many
11 pains in the neck that occurred up at the Hanford
12 tanks, and so somebody had to go off and do it.
13 So I don't know if we can routinely do the
14 partial pressure calculation here or not.
15 MR. WESCOTT: You know, from most of my
16 experience, and that's with hydrogen, and that also
17 involves reactors, we generally approach the problem
18 through dilution, and instead of worrying about just
19 exactly where the LFL is, we provide enough dilution,
20 and the same with the Hanford tanks. You provide
21 enough dilution so that you're nowhere near the LFL.
22 And I think with some of these situations
23 maybe that's going to have to be the solution, and
24 your main alarm is not if you've approached LFL, but
25 if you've lost air flow. You know, and then you --

1 CHAIRMAN POWERS: Well, I just want to ask
2 you. When you take 25 percent of LFL as a design
3 basis for 60 percent with automatic tracking, which I
4 think is what you actually say, it's 25 percent of
5 what.
6 Like I say, if it's 25 percent of the LFL
7 for dodecane, I mean, I've got some design
8 flexibility, shall we say? But if it's 25 percent of
9 the actual combustibility of the liquid you would
10 really have there, which it should be, then you've got
11 a much more challenging thing.
12 MR. WESCOTT: Well, yes, you do. I mean,
13 if you've got other gases that have low flammability
14 levels coming off in significant quantities at the
15 temperature, you've got to calculate what your LFL
16 really is for the mixture. There's no way around it.
17 CHAIRMAN POWERS: So I guess what I'm
18 asking you is it's 25 percent of LFL what. Of liquid?
19 MR. WESCOTT: Of what they actually do.
20 MR. MURRAY: What they actually have, yes.
21 MR. WESCOTT: Yeah, that's right.
22 MR. MURRAY: Now, if they have proposed a
23 methodology for determining LFL and LFLs of mixtures
24 and we've looked at that. it is based on the standard
25 Le Chatlier's principle. Again, that is something

1 that is usually used in plants, process, industry
2 plants, and you know, we have concluded that what they
3 proposed is reasonable for mixtures.
4 Now, I'll also add there's a question
5 about measuring hydrogen. The applicant has
6 identified industry code standard, I guess I should
7 say, for both the type of hydrogen/flammable gas
8 censor and also its spacing. Okay? So that design
9 basis is in there, and I believe it's for areas where
10 either the hydrogen line runs through or a hydrogen
11 type generation can occur.
12 MR. WESCOTT: Okay, and this is the
13 hanford tank experience that we were talking about and
14 you had mentioned that hydrogen is not to exceed 25
15 percent of the LFL, and this was based on, you know,
16 the actual physics, the overturning type of thing, the
17 rapid increase in hydrogen concentration and their
18 interpretation of NFPA-69.
19 This is electrolytic hydrogen. It's
20 hydrogen formed from electrolysis, and this shows how
21 the concentration of nitric acid in the solution can
22 control the hydrogen generation. As your molar
23 concentration of acid increases, your ability to
24 generate hydrogen basically decreases, and so that
25 becomes the control on electrolytic production of

1 hydrogen, is maintaining the --

2 DR. WALLIS: Circles don't do a very good

3 job of going through any of them relating to the

4 curves.

5 MR. WESCOTT: Well, --

6 CHAIRMAN POWERS: Actually my reaction to

7 that was totally different, Graham. I said for

8 electrochemical data, that's fantastic.

9 (Laughter.)

10 MR. MURRAY: That was my reaction as well.

11 MR. ROSEN: Peter, can't you get your

12 electro materials to behave better than that?

13 CHAIRMAN POWERS: It's especially bad with

14 stainless steel. You should have spent more of your

15 career working in plastics, Peter.

16 DR. WALLIS: Well, that's what we did

17 finally.

18 MR. MURRAY: I just want to mention this

19 curve is in the open literature. It comes from some

20 of the experimental work performed at Pacific

21 Northwest Lab, and the important parameter here is if

22 you notice this is a hydrogen concentration in the

23 involved gases, and one percent is nominally 25

24 percent of the LFL. Okay. LFL and hydrogen under

25 normal conditions is about four percent, right?

1 And you can see if you're above about a
2 two normality, two normal nitric acid solution, that
3 both of these curves are clearly below the 25 percent
4 of the LFL.
5 DR. WALLIS: But all of the data are, too.
6 MR. MURRAY: Yes, yes, yes. Now, again,
7 we're doing the construction application review. All
8 right? And we're looking at the fluidability of the
9 proposed control, which is to control the nitric acid
10 concentration, which is a catholyte, by the way; it's
11 nitric acid.
12 All right. It's very clear that, hey, if
13 I go to higher acid concentration, I am definitely
14 below the LFL based on this data. Now, for the
15 specific electrode materials, which the applicant
16 decides upon in the final design, we would look for
17 some assurance that, you know, this type of phenomena
18 still applies.
19 But it's very clear you can control
20 hydrogen generation under normal conditions by nitric
21 acid concentration.
22 DR. RANSOM: In any of these applications
23 do they consider recombiners?
24 MR. MURRAY: There's no proposed
25 recombiner in the current MOX design.

1 MR. WESCOTT: One thing I might add is
2 we're talking about concentrations basically inside
3 process vessels. We don't have any situations where
4 we've got, say, concentration inside a containment
5 structure or anything this large.
6 DR. WALLIS: Well, this figure here, this
7 is mole concentration in what?
8 MR. MURRAY: Oh, this is in the gaseous
9 base or gaseous.
10 DR. WALLIS: So what's the other phase?
11 MR. MURRAY: This is the liquid phase,
12 catholyte.
13 DR. WALLIS: What's the other gas?
14 MR. MURRAY: I'm sorry?
15 DR. WALLIS: What is the other gas?
16 MR. MURRAY: Some of the other gases they
17 get here are NOX, N_2O, NO_2. I'm sorry?
18 DR. WALLIS: There's air presumably if
19 that's what you're worried about?
20 MR. MURRAY: They do get some nitrogen,
21 okay, but understand this Y axis here refers only to
22 the gases which are evolved. It doesn't refer to any
23 cover gas. All right?
24 DR. WALLIS: So you're evolving something
25 else.

1 MR. MURRAY: Yes, nitrogen oxides and
2 nitrogen. Again, it's an artifact of using nitric
3 acid as the catholyte. If you're putting electrical
4 current across nitric acid, you do get some reduction
5 at the cathode, and some of the reactions are
6 mentioned in the FSER. All right?
7 DR. WALLIS: And this is the hydrogen
8 concentration in NOX to prevent a NOX-hydrogen
9 reaction. Is that what you're talking about?
10 MR. MURRAY: I'm sorry?
11 DR. WALLIS: Are you talking about a NOX
12 hydrogen reaction or an air hydrogen reaction?
13 MR. MURRAY: Because the ullage space
14 above the electrolyzer in the proposed plant would be
15 an airspace, okay, our concern would be for it in an
16 airspace. However, what this says here --
17 DR. WALLIS: Hydrogen will react with NOX,
18 won't it?
19 MR. MURRAY: It depends on time,
20 concentration, and temperature.
21 DR. WALLIS: Right, on concentration.
22 MR. MURRAY: Yes, under certain
23 circumstances it can react with NOX.
24 CHAIRMAN POWERS: Yeah, but did Joe
25 Shepherd look at the combustion limits on there and

1 find out that they're actually not as bad as air?

2 MR. MURRAY: I think he did, but I'd have

3 to --

4 CHAIRMAN POWERS: It takes more effort to

5 react with NOX.

6 MR. MURRAY: Yeah. In the case of NOX-

7 hydrogen reactions, they tend to require a much higher

8 initiating energy, if you will, to get ignition. In

9 addition, the ranges, flammability ranges are much

10 higher.

11 CHAIRMAN POWERS: The lower flammability

12 limits like five or six percent or something like

13 that.

14 MR. MURRAY: Yeah, yeah, yeah.

15 CHAIRMAN POWERS: So, I mean, the answer

16 is yes, but if you can meet the air criterion, you're

17 okay in N_2O.

18 MR. MURRAY: Yes. Any other questions on

19 this Figure 4 from the electrolyzer?

20 (No response.)

21 MR. MURRAY: Okay.

22 MR. WESCOTT: And here's the last figure,

23 our conclusions, and basically the staff accepts the

24 preventive strategy that was proposed by the

25 applicant. Staff accepts the general use of NFPA-69

1 as a design basis. Staff will review implementation
2 to check to make the proposed interlocks where they're
3 proposing a 60 percent level, for example, or 50
4 percent, can perform their safety functions adequately
5 to prevent an explosion or a fire.
6 The applicant has different strategies to
7 pursue, a number of ways of arriving at the desired
8 result. Clear calculation on an experimental basis
9 will be needed. For example, what actually is the
10 behavior in terms of vapor pressures and LFL? So the
11 actual solution that's in there.
12 DR. WALLIS: Those are the things we see
13 later?
14 MR. WESCOTT: Those are the things, right,
15 that we will be looking at during our review.
16 You know, a review, of course, is an
17 audit. I mean, we'll look at where we think the
18 problems are, but we'll probably be looking at this
19 in some detail, and we consider it acceptable for
20 construction under the proposed strategies.
21 DR. FORD: Would you mind just going back
22 to the previous diagram?
23 MR. WESCOTT: Sure. Oh, boy.
24 (Laughter.)
25 CHAIRMAN POWERS: You wouldn't mind, but

1 the computer would.

2 MR. WESCOTT: Let's see. There we go.

3 Wow, I got over this one.

4 MR. MURRAY: Science is wonderful.

5 DR. FORD: In order to get a reasonable

6 efficiency in terms of the reaction you're trying to

7 do, you've got to have a certain nitric acid

8 concentration, don't you?

9 MR. WESCOTT: Yes.

10 DR. FORD: So what is that value? I think

11 I saw six molar nitric acid mentioned somewhere, I

12 think. Is that right?

13 MR. WESCOTT: I believe that's in the SER.

14 DR. FORD: So you're stuck at six molar;

15 is that right?

16 MR. WESCOTT: Could you explain what you

17 mean by "stuck at six normal"?

18 DR. FORD: In order to have an efficiency

19 in the process you're trying to do, you presumably

20 want to have as high a nitric acid concentration as

21 possible; is that right? No?

22 MR. WESCOTT: Well, you're talking

23 efficiency now. So that's sort of outside the range

24 of a safety review, but let me just comment.

25 DR. FORD: Yeah, okay.

1 MR. WESCOTT: Let me just quickly comment
2 on that. Because of the type of reactions that are
3 going on and design of typical cells like this, your
4 electrodeficiencies may be quite low, 50 percent tops,
5 something like that.
6 A lot of the electrical energy ends up in
7 either heat or other auxiliary reactions occurring at
8 the electrodes. Okay? And one of them --
9 DR. FORD: I was just trying to work out
10 what the message from this diagram was in terms of
11 managing your flammability aspect. Obviously you want
12 to have as high a concentration as possible.
13 MR. WESCOTT: Exactly. If you increase
14 your asset concentration, okay, and again, this is
15 around the cathode, all right? This diagram shows
16 that you can control the evolution of hydrogen, i.e.,
17 you can keep it below the 25 percent of LFL limit. If
18 you had no air sweep or no ventilation on this system,
19 this would be the hydrogen concentration evolved in to
20 the ullage space.
21 MR. BROWN: Alex, if I may interrupt.
22 MR. MURRAY: Sure.
23 MR. BROWN: This data is for an
24 electrolyzer of some design, not necessarily of the
25 plant we're looking at. This curve would essentially

1 have to be reestablished for the final design.

2 DR. WALLIS: Yeah, i was going to ask:

3 aren't there some other variables to determine this?

4 MR. BROWN: Right. The size and shape of

5 the electrolyzer, I'm sure, the current densities, and

6 that sort of thing.

7 MR. ROSEN: What we heard earlier would be

8 tantalum and it won't even be platinum. Maybe it

9 might be --

10 MR. BROWN: I believe the material

11 platinum cathode is right, as shown here. What's

12 intended by this figure is the concept of generation

13 control with nitric acid concentrations. The data

14 will be different.

15 DR. FORD: It's also telling you that if

16 the licensee wanted to use platinum, that would

17 increased the efficiency of his process. You'd say,

18 "Hold on a bit. You can't go too far in that

19 direction because you're going to increase my

20 flammability aspect."

21 CHAIRMAN POWERS: No, I wouldn't say that

22 at all. I would say, "Look. It doesn't matter

23 whether I use stainless steel or platinum." I mean,

24 these are --

25 DR. FORD: As long as you blow --

1 CHAIRMAN POWERS: As long as I'm below,
2 I'm below. I mean, it doesn't matter. You can never
3 get this gas to be combustible, unless I run it into
4 something that's going to freeze out whatever the
5 diluent gas is. I mean, I'm fat here. This is great
6 because he's going to have to stay above three molar
7 to keep from precipitating out the plutonium dioxide
8 to begin with.
9 Now, I can imagine current density makes
10 a difference and material makes a difference, but I
11 can't imagine geometry really making much of a
12 difference here, can you? I mean, it doesn't seem
13 like it because it all depends on what the over
14 voltage of hydrogen is, the over potential on hydrogen
15 production at the electrode is.
16 MR. MURRAY: That's correct.
17 DR. FORD: Your stir rate is going to
18 affect it. The hydrogen evolution is going to be
19 diffusion control to a large extent. The reason for
20 my question was --
21 CHAIRMAN POWERS: The total amount of
22 hydrogen I produce, but not the gas production here.
23 I mean, as a fraction of the gas production rate why
24 would it affect that? I'd have to think about that a
25 little bit.

1 DR. FORD: Well, the reason for my
2 question was flammability, managing the flammability
3 aspect, you would use such data to essentially
4 reassure yourselves that even using different
5 materials, which you might use for various business
6 reasons, you're still well within your flammability
7 limit. That's essentially the message from this
8 diagram; is that right?
9 MR. MURRAY: Partially right. The main
10 message from this diagram is, yes, you can control
11 hydrogen evolution and keep it below the LFL by
12 controlling the nitric acid concentration. That's the
13 main message.
14 So there will be some bumps on these
15 curves for different electrodes. Okay? I haven't
16 seen any information on, say, tantalum. Is it in the
17 middle if it's a palladium coated? Is it above
18 platinum?
19 But the basic concept that this control
20 philosophy of using nitric acid to control hydrogen
21 generation is a reasonable approach.
22 DR. DENNING: Could you take me back to --
23 I'm trying to read the slide up here -- 66, I guess?
24 CHAIRMAN POWERS: What, are you testing?
25 It takes him quite a while. You're a little bit slow

1 on the uptake here, aren't you, Rich?

2 DR. DENNING: Okay. These are the six

3 areas of applicability that you were considering.

4 Could you then interpret for us again your bottom line

5 conclusion?

6 I have the feeling that what you've done

7 here is rather than looking at these areas in detail

8 and seeing how the applicant is going to demonstrate

9 satisfaction, that what you've really developed is

10 more criteria that they have to satisfy. You don't

11 know exactly how they're going to do it at the moment.

12 You just have developed criteria. Is that a fair

13 comment?

14 MR. WESCOTT: I think that's a fair

15 statement. Now, they have made proposals as to how

16 they intend to do it, and I think in many of these

17 ways they're going to be -- some of them are going to

18 be looking at temperature control. Of course, in the

19 electrolysis area they're looking at nitric acid

20 control. I think there may be a few --

21 DR. DENNING: Is that the way I interpret

22 like in number three? The PSSC is high temperature

23 control in acid recovery. Is that what you're

24 implying here or am I not -- or is it that's the

25 concern?

1 MR. BROWN: That's the concern.

2 MR. WESCOTT: Yeah.

3 MR. MURRAY: This is merely a title for

4 the area of applicability.

5 DR. DENNING: Area of applicability. So

6 as far as the risk that they can't satisfy these, I

7 mean, obviously DOE is the one who really has a risk,

8 and they're going to go ahead and they're going to

9 construct under the assumption that they can satisfy

10 the criteria that you've established, and then if they

11 can't satisfy those criteria, then they may be forced

12 to go back in and do some system redesign to be able

13 to do that. Is that --

14 MR. WESCOTT: That's always possible. I

15 mean, if they can't satisfy it with temperature, they

16 may have to look at redesigning their off-gas system

17 to get possibly more dilution or something like that.

18 I mean that's certainly possible..

19 DR. DENNING: It just isn't exactly clear

20 to me how far you have to go in deciding they're ready

21 to go ahead and construct, you know, since I don't

22 think -- but I may be wrong -- that you've looked at

23 this in real detail because all you've done is really

24 kind of established the criteria rather than really

25 looking and saying, yeah, I'm fairly confident that

1 the PSSC that they have established is going to be
2 satisfactory and meet that criteria.
3 MR. WESCOTT: That's exactly right.
4 That's the kind of conclusion we're coming to from a
5 safety assessment standpoint that we expect that they
6 will be able to satisfy the performance requirements
7 of the regulation, but we will verify that when we see
8 the final design.
9 MR. MAGRUDER: Let me just clarify a
10 little bit. We have also to reach the conclusion that
11 we have reasonable assurance that they can meet the
12 criteria. I mean, it's not just, yes, that this is
13 the right standard to apply, but we also have to have
14 some confidence that what they're proposing or that
15 there is a feasible approach to meet the requirement.
16 MR. WESCOTT: Right. We don't see any of
17 these problems are requiring a total redesign of their
18 process, you know.
19 MR. ROSEN: On the other hand, DOE can
20 take no comfort from this approval of construction.
21 The burden is still really on them to come up with
22 designs that through the ISA process you can agree
23 meet these criteria.
24 MR. WESCOTT: Yeah. I mean, really when
25 you look at the regulation, most of the emphasis on

1 CAR review is, of course, on structural design and
2 seismic. I mean, we're trying to avoid situations
3 that can't be undone, you know, which I think is the
4 main emphasis where process design is probably where
5 we don't want to force them to redesign their whole
6 process either.
7 But I think we tend to feel that the
8 designs to meet the performance requirements that we
9 have approved will be relatively minor differences.
10 MR. MAGRUDER: I will add that in some
11 areas we've pressed them pretty hard to make sure that
12 we were satisfied that there is a feasible approach
13 out there, but the question is, you know, the million
14 dollar question is: how far do you have to go to
15 satisfy yourself that the construction is okay, as
16 opposed to waiting for the detailed design.
17 MR. MURRAY: You know, just to clarify
18 this a little bit more, the applicant has committed to
19 an NFPA-69, a code, if you will. That code outlines
20 a number of approaches, activities with different
21 limits which would, if you will, prevent a flammable
22 event from occurring. All right?
23 There is a general limit identified, which
24 is 25 percent of the LFL. In addition, there's also
25 an exception which can be up to 60 percent of the LFL

1 if automatic interlocks are available and reliable.
2 All right?
3 In the revised construction authorization
4 request, the applicant for two of those areas of
5 applicability wanted to propose and did propose
6 interlocks. All right? The staff looked at what the
7 applicant had proposed, and we had no clear
8 calculational or other basis at this time to say that,
9 yes, these PSSCs, these interlocks, if you will, could
10 function the way NFPA-69 anticipates.
11 All right. So the staff took a step back
12 and said, "Okay. We understand you want to follow
13 NFPA-69. We know NFPA-69 has been applied to
14 situations like this. We think we can accept it as a
15 design basis, and we put the onus on the applicant
16 that in the license application if they wish to
17 pursue, if you will, interlocks, then they're going to
18 have to get a very clear, calculational basis as to
19 why those interlocks should function and, if you will,
20 maintain safety, perform the safety function, I should
21 say.
22 Does that help or did I confuse the
23 situation more? Dana is smiling. That's a good sign.
24 MR. ROSEN: Well, I'm smiling because I'm
25 thinking about the 2,700 pages we've looked at

1 supposedly, and the promises you've made about the
2 rather lengthy detail that will be included in the ISA
3 compared to what we now have. The estimate to the
4 Chairman was 27,000 pages, but maybe I'm off by a
5 factor of two.
6 MR. MURRAY: You're probably in the
7 ballpark. It will be several thousand pages in the
8 ISA at least.
9 CHAIRMAN POWERS: Yeah.
10 MR. ROSEN: Well, I'm thinking about the
11 final. Is there another document from applicant
12 that --
13 CHAIRMAN POWERS: Yeah, that's the ISA.
14 MR. ROSEN: -- upon which -- yeah, the ISA
15 itself, 10,000 pages; your analysis of the ISA, 5,000
16 pages.
17 CHAIRMAN POWERS: No, they're just saying
18 it looks good to us.
19 MR. SIEBER: You mean the operating
20 license application.
21 MR. BROWN: Just to clarify --
22 MR. ROSEN: Put it on a scale of three
23 significant digits.
24 MR. BROWN: There is a bit of a nuance.
25 Since the applicant is required is required to

1 complete an ISA and submit an ISA summary, so there is
2 a much more substantial ISA available for staff review
3 that's not provided on the docket.
4 CHAIRMAN POWERS: I mean, it's also
5 available to us to review as well, but at his
6 facilities.
7 MR. BROWN: Correct.
8 CHAIRMAN POWERS: And as you may have
9 detected in some of the questions, I think it's
10 unavailable to actually go down and spend some while
11 looking at that to at least spot check it.
12 MR. ROSEN: Where is that?
13 CHAIRMAN POWERS: It doesn't exist now.
14 MR. ROSEN: No, but where would be go?
15 CHAIRMAN POWERS: Savannah River.
16 DR. WALLIS: Can't these 10,000 pages be
17 boiled down to something we can digest.
18 MR. SIEBER: Yeah, two slides.
19 DR. WALLIS: In particular, five key
20 things like red oil runaway reactions and hydrogen
21 flammability and so on, why can't that be put into a
22 small volume in which the essence of what we need to
23 know is contained instead of us having to dig through
24 this mountain of stuff? Trying to get somehow on a
25 computer that diagrams so that we can see them and not

1 spread over several pages, isn't there some way
2 someone can concentrate it for us so we can look at
3 what we need to see and not everything else?
4 CHAIRMAN POWERS: My experience has been
5 that, yes, no trouble at all. I could get it down
6 into the five things that you are interested in.
7 Unfortunately, the five things you're interested in
8 are not the same as the five things that Peter is
9 interested in, which are totally orthogonal to the
10 five things that Jack is interested in.
11 DR. WALLIS: But I mean things for the
12 decision making, that's all I care about. I will be
13 interested in them if they matter. It's not a
14 question of --
15 CHAIRMAN POWERS: Well, I mean, the things
16 that are put into this document, I mean, it seems to
17 me that one can make an argument that they all matter.
18 DR. WALLIS: Well, let's see. Which
19 things can the ACRS have any influence on that's been
20 on -- where can we add value. We're not going to add
21 value on 10,000 pages.
22 CHAIRMAN POWERS: Well, right now we don't
23 have to deal with the 10,000 pages. Let's deal with
24 our 2,700 right now.
25 Anything else on the flammable gas issues?

1 MR. WESCOTT: I had one slide, but I'm
2 afraid to go after it because I don't know what --
3 DR. WALLIS: You have a flammable slide?
4 (Laughter.)
5 DR. BONACA: I would like to just ask one
6 more question regarding this issue. I think from this
7 conversation that we're having now, it seems as if
8 we're talking about purely conceptual design here with
9 no reference of experience or anything out there about
10 how possibly successful these measures can be.
11 But my understanding -- and, you know, I'm
12 not an expert in this area -- but my understanding is
13 there are facilities using very much these kind of
14 processes.
15 We also visited a facility in Avignon
16 which I thought --
17 MR. WESCOTT: Absolutely.
18 DR. BONACA: So I mean, there is more than
19 just a sense that probably --
20 CHAIRMAN POWERS: I mean, I thought that
21 that was Alex's point. A standard exists. We know
22 the standard has been applied to similar facilities.
23 Therefore, it's plausible that -- I mean, I think
24 that's what he said.
25 DR. BONACA: Yes, but I think you know,

1 one of the reasons that I have been curious about this
2 as it evolved is that for normal reactor facilities,
3 we don't go through a conceptual design approval
4 phase. I don't think there is a separate phase in the
5 licensing process.
6 MR. ROSEN: There used to be a PDAR and
7 the FSAR. Now we have one COL.
8 DR. BONACA: Yeah, yeah.
9 MR. ROSEN: It's very analogous to what we
10 used to have.
11 DR. BONACA: It's very analogous probably.
12 Well, it is.
13 CHAIRMAN POWERS: I mean, it seems to me
14 that this has some advantages in that it was clear,
15 for instance, that in the original application the
16 applicant did not consider titanium fires to be a
17 hazard. And so the NRC was able to say at that stage,
18 yeah, you need to think about this. Put in some PSSCs
19 here, rather than hitting them after he had
20 essentially completed the design.
21 MR. ROSEN: Poured the concrete.
22 CHAIRMAN POWERS: And so I mean, it makes
23 sense. It's a little bit frustrating for the staff,
24 a little bit frustrating for us because every time we
25 ask you, okay, what was the tradeoff study on the

1 particular width and dimension of the electrolyzer or
2 something, well, nobody has that information right
3 now. We'll get over it.
4 DR. BONACA: One of the encouraging things
5 I seem to have heard through these meeting is that
6 there is an expectation that the level of safety for
7 this facility seems to be much more automated. It
8 would be higher than existing facilities in the U.S.
9 now, and that's what I believe yours is probably, I
10 mean, from what I got from your comments.
11 MR. SIEBER: I'm not sure that gives us
12 comfort, if you know what I mean. One of the
13 interesting things that I think sort of sums up the
14 attitude of the applicant is that they write in their
15 Chapter 15 of the application, which is entitled
16 "Emergency Planning," that because of the controls
17 that are established in the construction of the plant
18 that the applicant intends to prove they don't need to
19 have emergency planning, even with the shrunken
20 uncontrolled area that they have, which I guess I keep
21 pondering that statement over and over again to make
22 sure in my mind. You know, that's a pretty high
23 hurdle to put out there and prove that you don't need
24 any kind of emergency planning.
25 CHAIRMAN POWERS: I can't imagine the site

1 letting them do that.

2 MR. SIEBER: I think that they intend to

3 participate in the site's emergency plan, but it

4 seemed to me that from the standpoint of the hazard

5 from this facility it doesn't extend beyond the owner

6 controlled boundaries, but obviously there are other

7 things at the Savannah River plant, too.

8 CHAIRMAN POWERS: Yeah, there are a lot of

9 things going on at Savannah River.

10 MR. SIEBER: There's more than this going

11 on there. At least there was the last time I was

12 there.

13 DR. WALLIS: There's no emergency plan for

14 this plant?

15 MR. SIEBER: Well, Chapter 15 says the

16 applicant establish emergency planning isn't needed.

17 DR. WALLIS: Because events are so

18 unlikely?

19 MR. SIEBER: It doesn't say "because." It

20 just says they intend to show that it is not needed.

21 MR. ROSEN: Basically they have prevented

22 all of the events is why, is what they've said.

23 MR. SIEBER: Well, to me that shows a

24 measure of confidence that I think --

25 MR. ROSEN: One hundred percent of the

1 time.

2 MR. SIEBER: -- poses a challenge to me,

3 anyway.

4 DR. WALLIS: Well, the introduction talks

5 about things like aircraft and so on, and we don't

6 believe that would require an emergency plan.

7 CHAIRMAN POWERS: I believe actually those

8 things were screened out.

9 DR. WEINER: Yeah, they were screened out.

10 DR. WALLIS: We just don't want to

11 consider them?

12 DR. WEINER: There is a site emergency

13 plan for Savannah River, and they could at least have

14 said --

15 DR. WALLIS: Well, they said that. They

16 recognized the site has an emergency plan.

17 CHAIRMAN POWERS: Let's let Rex get

18 through this. Are you done, Rex?

19 MR. WESCOTT: Yes, sir.

20 CHAIRMAN POWERS: Okay. What I propose,

21 that we go ahead and take a --

22 MR. MURRAY: Dana, we just have like three

23 more slides to finish off.

24 CHAIRMAN POWERS: I know. I want to go

25 ahead and take a break.

1 MR. MURRAY: Okay.

2 CHAIRMAN POWERS: And come back and that
3 will give us -- there's a method to my madness here.
4 I'll let you go through your three sides, but I think
5 we wanted to go through a little more discussion
6 before we move on to the next issues.

7 MR. MURRAY: Okay.

8 CHAIRMAN POWERS: And we've got a little
9 time here. I think we're still struggling a little
10 bit philosophically here. Maybe give us a few minutes
11 just to discuss things a little bit because we have
12 really two chores here. One of them, which is
13 directly pertinent to you, is to say out of all this
14 material you've put together, plus a huge amount of
15 introductory material that probably is necessary for
16 the full committee, that, you know, what fraction of
17 that should you really want to present, and I invite
18 you to participate in that discussion.

19 We need to give you some sort of marching
20 orders or guidance on that because you will have at
21 most a two-hour period, and they will not want you to
22 talk for more than an hour. That means a considerable
23 condensation of this, but you're going to have to do
24 more background material because you've got to tell
25 people better what the facility is, even if people on

1 the committee know. You may have people from the
2 public in the audience that are not going to have a
3 clue what you're talking about, and so we need to
4 mutually decide what that is, and then you need to
5 make sure that we're as close to on board to your
6 thinking and philosophy here as is feasible to get
7 because we're going to end up drafting a letter that's
8 going to go in front of the committee, and they're
9 going to massage that. I doubt that the full ACRS is
10 going to dream up a wholly orthogonal letter all by
11 itself.
12 And so we want to make sure that we're in
13 line with all of your thinking. One of the areas that
14 I've got to know more about is we have identified at
15 least one case where we've come in and said, "Okay.
16 Here's our position and here's the staff's position.
17 They're not the same," but that's not labeled an open
18 item.
19 I noticed a couple of other areas where
20 you discussed with the applicant, and you said, yeah,
21 this was a hazardous area. You didn't mention it in
22 your original application, but they said, "Yeah, we
23 agree," and we'll handle it with administrative
24 controls," even though DOE has standards.
25 And you point out, well, they didn't cite

1 a standard here and we think we ought to. Okay. I
2 would really prefer not to try to go find all of those
3 things. If we could talk about that just a little bit
4 and give me some guidance on where to look for a
5 summary on those because we're going to have to
6 understand those pretty well.
7 So the method to my madness was it seemed
8 to me that followed better from your summary than to
9 do the summary and then come back.
10 MR. MURRAY: Okay, that's fine.
11 CHAIRMAN POWERS: So I thought we'd take
12 a break until 20 after, come back and do that, with
13 the idea of bringing that discussion which could just
14 go on forever to an end at four o'clock, and then move
15 on to the next item on the agenda.
16 Does that sound like a strategy? Good
17 enough.
18 And, by the way, I iterate these
19 subcommittee meetings are kind of times for
20 discussions and whatnot, and the presentations have
21 been just right on the mark as far as technical detail
22 and topics and the presentations have been excellent.
23 So you're doing exactly what we need to hear.
24 MR. MURRAY: Thank you.
25 CHAIRMAN POWERS: So 20 after.

1 (Whereupon, the foregoing matter went off
2 the record at 3:05 p.m. and went back on
3 the record at 3:25 p.m.)
4 CHAIRMAN POWERS: Let's come back into
5 session.
6 Okay. In this session what I wanted to do
7 was to allow the staff to go through their summary
8 slides where they think they stand, and then I'd like
9 to chat just a little bit about various topics that
10 people have on their mind, but mostly work to help try
11 to define what we think ought to come forward to the
12 full committee meeting, and I'll talk about what my
13 view on that is, but I'll actually ask everybody
14 around the table what items they think should come
15 forward.
16 Mr. Rosen, you had a question?
17 MR. ROSEN: Yeah, just a question. Have
18 you been sort of collecting the key points that have
19 been made around the table so you can kind of spew
20 them back to us at least?
21 CHAIRMAN POWERS: Well, what I plan to do
22 actually is tomorrow after we have a presentation on
23 criticality, we're going to go back to our technical
24 points on that. That's in our function of developing
25 an outline for a draft position for the committee to

1 look at.

2 MR. ROSEN: That will be tomorrow.

3 CHAIRMAN POWERS: Yeah, I want to do that

4 tomorrow. I want to spend a little while discussing

5 philosophical aspects of this, as well as technical

6 details because, I mean, what we've done here is go

7 through really what the outstanding issues were from

8 our previous meeting on this subject, but there are,

9 in fact, 15 chapters in this that we need to think

10 about, whatnot, and we need to give the staff some

11 help because they're going to at best, I suspect get

12 about a two-hour period. Well, we only let them talk

13 for an hour, and I don't think they can come in with

14 a presentation with this excerpt out of the whole

15 thing. So I think we need to discuss that.

16 Dave, you want to go ahead and wrap up

17 what you presented?

18 MR. BROWN: Yes. Let me just finish up

19 for Alex, and this is his summary conclusion, which is

20 that now all of the open items are closed in chemical

21 process safety, and that the applicant has provided

22 reasonable assurance of protection against natural

23 phenomena hazards and accidents.

24 In addition to the previous conclusion

25 with regard to 7023(b), we have concluded that the

1 applicant has met the baseline design criteria, which
2 is also a new feature of the revised Part 70 when it
3 was revised to be a little more risk informed.
4 I think just overall I think some
5 highlights of the last four years is that the
6 regulation was revised in September of 2000. We
7 received the application just a few months after that.
8 So this was one of the first applications to go
9 through the new risk informed Part 70 regulation.
10 On top of that was the special
11 circumstances surrounding a plutonium facility, which
12 is a two-step licensing process.
13 But despite this being kind of a first
14 time exercise, I think that we've done a good job,
15 that the staff working together with the applicant has
16 improved safety, and that there are some changes that
17 we've asked the applicant to make to adjust some of
18 the hazards that we've talked about here today, and
19 that overall we've added value to that process, which
20 I think goes strongly against any sentiment that NRC
21 rubber stamps anything.
22 So with that statement I'll conclude and
23 be willing to answer any questions first, I guess.
24 CHAIRMAN POWERS: I guess the first
25 response I have is on your slide 70, "have

1 satisfactorily addressed by additional controls and
2 safety strategies," and I come back to the Level
3 I/Level III chemical concentration controls where you
4 said, yeah, we're going to accept this with a codicil,
5 and I'm not sure that the applicant is 100 percent
6 aware that that's what you're doing.
7 I mean, there's not an agreement from
8 them. How many other things do we have of that
9 nature?
10 MR. BROWN: Of that nature? That is
11 something that we will continue to talk to the
12 applicant about, and we certainly will keep you
13 apprised of any changes that do result from that.
14 I am not really -- and I'm earnestly,
15 sincerely thinking back through -- there should be
16 nothing else of that nature in the --
17 CHAIRMAN POWERS: Well, I know there's one
18 in which you identify a hazard. I can't remember what
19 the hazard is unfortunately right now, and point out
20 that DOE, too, thinks it's a hazard, has a standard.
21 The licensee agrees that it's a hazard, but proposes
22 administrative controls and doesn't cite the standard,
23 and apparently you don't like that very much. I have
24 to look.
25 MR. BROWN: I'm not sure I understand what

1 you mean. What event was that that we're talking
2 about?
3 CHAIRMAN POWERS: I'll have to look
4 through my notes to find it for you, but I will.
5 MR. BROWN: Okay.
6 CHAIRMAN POWERS: And so I'm just
7 wondering. I mean, do I have to go through and look
8 and find these not quite full agreement sort of
9 things?
10 MR. BROWN: No. The other area where we
11 did not accept the design bases that were offered was
12 actually something Chris Tripp will talk about
13 tomorrow, was the criticality safety where for MOX
14 powders we did not feel that there was sufficient
15 benchmark experiments to support the subcritical
16 margin that was proposed.
17 So we added an additional one percent non-
18 parametric margin. That was made clear to DCS, and it
19 has been communicated to them by letter I think about
20 April last year or April of this year I should say,
21 2004, and DCS has not approached us to have additional
22 conversations about that and seek any relief from that
23 condition.
24 MR. ROSEN: So they're just going to leave
25 it in the license application the way it is and have

1 you grant a license condition?

2 MR. BROWN: This is --

3 MR. ROSEN: It sounds like just holding

4 your breath until you turn bright red and die.

5 MR. BROWN: Well, no. The nuance here is

6 that these subcritical margins are not actually in the

7 construction authorization request. They're in a

8 related document called the criticality validation

9 report, provided on the docket, but not actually part

10 of the CAR. This condition is necessary, you know, to

11 establish that this is the limit, notwithstanding what

12 else is in your criticality validation report. We

13 would only accept this margin for MOX powders.

14 MR. ROSEN: So it's not like they're

15 standing on principle. It's just they don't know what

16 to change. You're going to require --

17 MR. BROWN: They wouldn't have, yeah, a

18 change to make.

19 MR. ROSEN: They're probably going to

20 license the change, the CAR for them to change.

21 MR. BROWN: Right. I think it's fairly

22 stated that DCS and DOE do not agree with NRC on this

23 matter, and so, you know, where NRC and an applicant

24 have reached an impasse, a condition is the

25 appropriate tool

1 MR. ROSEN: Yes, yes. You grant the
2 license.
3 MR. BROWN: Grant the license with the
4 condition required to protect safety.
5 CHAIRMAN POWERS: Okay. What I propose to
6 do is let's just walk around and address two things:
7 general comments you care to make and any guidance
8 you'd like to give the staff on what they ought to
9 bring forward to the full committee.
10 And after I've walked around the table,
11 I'm going to come right back to you, Dave, and your
12 team and ask you the same question, what you think
13 should be discussed in the letter and what you think
14 you ought to present to the full committee. So it
15 will give you a chance to think about those.
16 Ruth, why don't you lead us out here?
17 DR. WEINER: Okay. I'm going to defer our
18 general ACNW comment to my chairman, when you get to
19 him. I'd just like to make a personal comment about
20 the safety margins for chemical reactions in closed
21 systems. They make a number of assumptions that I
22 think are optimistic about the way thing really work.
23 In a mixture, the temperature is not
24 uniform, and I think very close attention should be
25 paid, in particular, to any closed system that they

1 have to what kind of safety margins are being left for
2 reactions, but I will defer comment on waste to Dr.
3 Ryan.
4 CHAIRMAN POWERS: Well, why don't we just
5 jump right straight to Dr. Ryan in that case?
6 DR. RYAN: Thank you very much.
7 First of all, I think we all three
8 appreciate the fact that you're at a conceptual design
9 stage and the details are coming, as we heard on many
10 of the issues that you addressed today, and I thank
11 you for that.
12 One of the issues that I think we all
13 think about focusing on waste is -- and I'll just read
14 this to you -- how has the waste management hand-off
15 to DOE/SRS been analyzed to assure that waste
16 management processes and systems don't create any MOX
17 plant safety challenges?
18 In other words, if there was a phone call
19 that said a waste pipe is closed, what does that mean
20 to you in terms of safety challenges?
21 And, again, I recognize that in an early
22 design stage that's kind of a very open ended
23 question, but it's something to think about as you go
24 from this stage on into the more detailed design step.
25 And would a interruption of waste

1 management services from the SRS/DOE site be factored
2 into the design and would immediate shutdown be
3 required? Could you shut down carefully over time?
4 You know, what kind of safety questions would you face
5 if you were told that that outlet can happen?
6 And you mentioned, I think, Allen comments
7 that you have acids and bases, and you know, would you
8 have to mix them? Would you have to dump them to some
9 kind of collection tank? You know, are there any
10 special issues that would result from that sort of a
11 force majeure or other imposed condition on you?
12 You don't control that aspect of it. So
13 that's something to think about, and again, we defer
14 to our colleagues here on the details of design.
15 Obviously they're the experts, but that's one that
16 kind of struck all of us as you talk through it today.
17 CHAIRMAN POWERS: Any comment on this
18 question?
19 MR. MAGRUDER: We agree that we ought to
20 pursue it, you know.
21 (Laughter.)
22 MR. MAGRUDER: I'm not sure what else to
23 say.
24 CHAIRMAN POWERS: Okay. That may be
25 enough.

1 MR. MAGRUDER: We agree. Do you want to
2 add anything?
3 MR. BROWN: Well, I'll just add and
4 perhaps repeat that, you know, we did consider the
5 safety implications of the waste that is stored inside
6 the MOX plant, and I think it has been our underlying
7 assumption that if those tanks were filled to capacity
8 they'd be forced to shut down.
9 DR. RYAN: That's not what we're saying
10 though. What we're saying is if your waste outlet
11 says you can't send this waste anymore, we've got a
12 problem. What does that do to you?
13 That happens to day. If your waste tanks
14 are near capacity and you've got a lot in process,
15 what's your excess --
16 CHAIRMAN POWERS: Well, I don't know if it
17 even matters that they're near capacity. It is merely
18 that they have to stop.
19 DR. RYAN: Yes, or have you evaluated that
20 kind of scenario that would causae you to rethink do
21 we keep going or not, under whatever set of conditions
22 you had?
23 So that's a different question than what
24 you just offered as an observation.
25 CHAIRMAN POWERS: In fact, it brings up

1 the point of your waste collection tank. You have
2 this waste collection tank at the facility that
3 receives all kinds of stuff. I mean, they go to some
4 lengths to describe all of the feeds that are coming
5 into it and their diversity.
6 I mean, how do you assess the safety of
7 that in light of the fact that that's exactly the sort
8 of tank that has created so many headaches for the
9 Department of Energy, one that's receiving lots and
10 lots of diverse waste streams.
11 DR. WEINER: That raised a question which
12 is really not part of NRC's purview, but is just
13 something generally to think about, and that is the
14 extent to which a facility like this will contribute
15 to legacy wastes that we're now dealing with.
16 CHAIRMAN POWERS: Otherwise known as
17 employment for waste.
18 DR. WEINER: Keep those people at Savannah
19 River going.
20 CHAIRMAN POWERS: Keep Yucca Mountain
21 green.
22 Professor Denning.
23 DR. DENNING: I'm not going to address any
24 of the real technical issues here, but I am struck by
25 the difference that I see between what we normally do

1 in approving something versus what I think our charter
2 is here, and I think that our charter here is
3 substantially less than it normally is.
4 I think normally we're really being asked
5 is something safe enough, and I think that in this
6 case -- and at some point I think we will address that
7 question -- but because of this two-step process, it
8 seems to me that the kind of three questions that I
9 see, and perhaps we can discuss these more when we get
10 to what our letter would actually say, but I think it
11 does have relevance to what they should be presenting
12 to us at the full committee meeting.
13 The first is: has the staff performed a
14 comprehensive review of the hazards represented by the
15 facility and the design bases and PSSCs proposed by
16 the applicant?
17 Has the staff developed appropriate safety
18 acceptance criteria?
19 And I think that the principal question
20 that we have to then address based upon that is: is
21 there reasonable assurance that the applicant will be
22 able to satisfy the safety criteria based on the
23 conceptual design?
24 CHAIRMAN POWERS: I mean, I'll look to
25 Dave, but it sounds very familiar to the language

1 we've been using.

2 MR. BROWN: Yeah, I don't have any

3 comment.

4 CHAIRMAN POWERS: I mean, it sounds like

5 we're aligned there in our thinking on what they're

6 trying to accomplish here,a nd I think it would be

7 useful to articulate those. I mean, we're going to

8 serve something of an educational function to the

9 Commission in our advice on this, too, and we're going

10 to have to lay this out.

11 And I think we will probably interact with

12 you guys on that aspect of the letter in draft form.

13 I mean, we're going to spend some time to make sure we

14 craft those words very carefully. So when it gets

15 time for that, please help us get the words in

16 precision there, and to articulate it out into three

17 questions like that might be very useful.

18 Vic, or Professor Ransom I should say.

19 DR. RANSOM: I don't have much to add. I

20 think I agree that from what I've seen, we're used to

21 looking at the details of a process and trying to

22 evaluate whether or not there are safety concerns.

23 I assume in this case, too, that the

24 consequences can be made small, and that the facility

25 reviewed in France at least, you have kind of like a

1 pilot plant line which --

2 CHAIRMAN POWERS: Well, it's an

3 interesting pilot plant in that it's bigger than the

4 one we're talking about.

5 DR. RANSOM: Really?

6 CHAIRMAN POWERS: Oh, yeah. The

7 throughput in France must be what, ten times this or

8 something like that?

9 MR. BROWN: With the MOX plant at least,

10 I think it has the capacity in France of 200 metric

11 tons per year. this is a 70 metric ton per year plant

12 in the U.S.

13 DR. RANSOM: I'm having a little bit of a

14 hard time getting my hands on what are the risks, you

15 know, involved in this kind of facility.

16 No other comments I don't think.

17 CHAIRMAN POWERS: Dr. Bonaca.

18 DR. BONACA: Well, referring to what

19 should be presented in February to the whole

20 committee, I think that's an interest you had. I

21 would echo somewhat what Dr. Denning pointed out. It

22 seems to me we have to go and talk about, you know,

23 the general safety assessment of the design basis.

24 You have a full chapter there in the SER,

25 Chapter 5, and you don't have to go in fanatically, as

1 I see the issue, but certainly talk about the issues
2 to do with nuclear safety and chemical safety. How
3 you have established those criteria in terms of the
4 point we were making there.
5 Particularly we saw today that table of
6 doses versus likelihood, and you referred to a NUREG
7 that contained those as some quantitative indication.
8 I think it would be valuable for us to have an
9 understanding of that.
10 Also you referred to the fact that we are
11 using chemical releases to determine risk also. So
12 also that kind of information, and I would keep the
13 presentation at the kind of high level to give a
14 sense of how you do have envelope to issue the
15 conceptual basis, and then at that point I don't think
16 you have to go into much detail, but you have to give
17 some basic understanding of why you believe that this
18 approach, this criteria can be met. And I would keep
19 it at a high level because I don't think we have that
20 much time. I think probably a couple of hours.
21 CHAIRMAN POWERS: Well, I mean we may make
22 an argument for it, but I think as a planning basis,
23 we plan on a couple of hours.
24 DR. BONACA: We're not doing anymore than
25 that.

1 CHAIRMAN POWERS: And I'm just guessing.
2 I mean, the problem is this. The facility encompasses
3 enormous numbers of technical fields, enormous numbers
4 of technical questions. There is no way to anticipate
5 the particular question that's going to excite
6 somebody. I mean, even the people that have been
7 sitting here, they're going to continue to review the
8 material, and you cannot prepare for everything.
9 So it's better to prepare for being
10 surprised or maybe not surprised, but prepare for
11 unanticipated questions. Make the presentation, as
12 Dr. Bonaca said, at a fairly high level. You can list
13 some of the particular issues as illustrations of your
14 approach, but it's really getting across your
15 approach, you know, not red oil is an issue.
16 DR. BONACA: That's right.
17 CHAIRMAN POWERS: But rather, here's what
18 we did.
19 DR. BONACA: One last comment I wanted to
20 make was regarding this issue of preventing versus
21 mitigating. I haven't heard a single word in the
22 presentation in regards to mitigation, and yet you do
23 have mitigating features, and it seems to me that you
24 call them preventative because anything that prevents
25 a dose you call it preventing, but that is like saying

1 in a reactor ECCS is a preventive. It's equipment
2 because it prevents doses from being released.
3 The reality, we consider it a mitigating
4 system, and I think you're doing a disservice a little
5 bit to what has been done and proposed by ignoring
6 that there are some theoretical issues there that you
7 include in your design.
8 CHAIRMAN POWERS: Yeah, I agree with you
9 that there's a definition of terms here, and I
10 particularly liked the way Dr. Bonaca characterized
11 it, and so you might want to in your introduction
12 acknowledge that there's a challenge in terminology
13 throughout this Part 70 versus Part 50, and use that
14 as an illustration of, you know, when you guys are
15 looking for a balance between mitigation and
16 prevention. We've got that, but the way we label
17 things it's a little different. So it might seem like
18 we don't.
19 And just acknowledge there's a difference
20 in terminology and hope that the members that are
21 maybe insensitive to that, the people here can help
22 them understand that better.
23 DR. BONACA: Those are my comments.
24 CHAIRMAN POWERS: Very good. Mr. Rosen.
25 MR. ROSEN: Yeah, I'd like to echo what

1 Mario just said about the differences in the
2 regulatory framework. I mean, I think that the other
3 members who haven't been involved won't really
4 understand, won't really have in their heads the idea
5 that this is really governed by Part 70, 7061, in
6 particular the performance requirements.
7 And it might be a little tutorial on that
8 up front may be very helpful.
9 The other thing I think that's of major
10 importance, and I'm not sure whether this falls across
11 the line into a technical question, but I'll talk
12 about it anyway, and that is the need, I think, for a
13 process overview in the facility, that is, -- and
14 these issues all tie together -- a control room where
15 the overall process is overviewed. The very existence
16 of such a space and the function itself, and the need
17 for someone to initiate an emergency plan which would
18 likely come out of that space to me is either a
19 glaring omission or either I don't understand it or
20 maybe there isn't a need for it, but it's so different
21 than what we're used to in the reactor world that I
22 think it bears some exposition, either explanatory of
23 why it's the way it is or maybe to say, well, we
24 didn't really give the subcommittee all of the answers
25 that maybe we could have or should have, and here are

1 some answers around the question of (a) a central
2 control room if it's needed and (b) how one initiates
3 an emergency plan, although the point is that the
4 applicant is saying they don't need one.
5 And then that's a very big issue, and I
6 don't see how we could reasonably go to the full
7 committee or even mention it to the Commission without
8 having addressed that issue. After all, the
9 Commission has just, I think, said in the area of
10 future reactors that emergency plans will be required
11 even for future reactors. Here's a current system
12 that's not a reactor, granted, but where the idea is
13 there isn't going to be one. I think it's a big
14 issue.
15 And I wanted to talk about this question
16 of the third issue that I think is a technical issue.
17 It's the issue of when you have an area where you need
18 to have moderation control, need to make sure the
19 water doesn't get into that area, that you're really
20 basically making a choice or making, let's say,
21 optimizing the choice, making a trade perhaps is a
22 better way to say it, between five protection as you
23 would normally design it in order to protect, I think,
24 the public's health and safety versus nuclear
25 criticality safety in the facility which is a

1 protection for the workers.

2 And you're making some sort of trade, and

3 the dimension of that trade are not exactly explicit

4 to me. Now, is that a technical issue? I don't know,

5 Dana.

6 CHAIRMAN POWERS: But I think it's a good

7 issue, and we need to explore that further. You and

8 I need to chat because we've got to understand this a

9 little better.

10 We're going to get a report from one of

11 our consultants on the nuclear criticality stuff.

12 Maybe at that --

13 MR. ROSEN: We can look tomorrow.

14 CHAIRMAN POWERS: Well, we'll hear more

15 about the criticality tomorrow. We're going to get a

16 report on that material from a consultant. Once we

17 have that in hand, then we need to explore it a little

18 more, and it may be necessary for us to sit down with

19 the staff and understand this a little better.

20 MR. ROSEN: Yeah. Well, I'm not sure

21 that's something that we would want to put in the full

22 committee discussion, but there it is. It's a big

23 issue.

24 CHAIRMAN POWERS: It is, I think, a useful

25 issue to pursue because this tradeoff is always a

1 challenge here, especially with the closer site
2 boundaries. We just need to understand the issue a
3 little better.
4 MR. ROSEN: That's all I have.
5 MR. MAGRUDER: I think, Dr. Powers, I
6 think that tomorrow morning when we talk about safety
7 issues we can get into this again. I think we have a
8 better story than we presented.
9 CHAIRMAN POWERS: Sure.
10 MR. MAGRUDER: I mean, this is definitely
11 something we should talk about, but I think that for
12 this particular design it may be less of an issue than
13 we think it is.
14 CHAIRMAN POWERS: So why don't we just
15 count on that, and we'll explore it a little further.
16 I understand it may take us a little while to get up
17 to speed here because we're still collecting our
18 information on this.
19 MR. MAGRUDER: Right, right.
20 CHAIRMAN POWERS: And if its necessary for
21 us to get together again and chat, I mean, we can
22 arrange that.
23 MR. MAGRUDER: Absolutely.
24 CHAIRMAN POWERS: This should not be an
25 onerous thing to do.

1 Professor Wallis.

2 DR. WALLIS: Well, what we heard today I
3 found to be at a very high level, which is where you
4 are so far, toward about approaches and principles and
5 in general terms the methods that were to be used to
6 control these various reactions and so on. But it was
7 very hard for me to tell which of these might turn out
8 to be a technical issue because I couldn't see enough
9 detail, and I don't yet know whether the design will
10 actually be adequate. So there's obviously a long way
11 to go.

12 I was helped by the discussions today of
13 a phenomena, such as red oil and HAN and all of this
14 kind of thing. It really helped me as opposed to
15 trying to just read the documentation. I found what
16 you presented today helped me there.

17 In terms of presenting to the full
18 committee, I'm not quite sure. Are you presenting the
19 whole draft SER on the entire CAR, in which case
20 you're going to talk about a lot of things besides
21 these open issues, or are you just going to talk about
22 the open issue resolution to the full committee?

23 MR. BROWN: No, I think we will have to go
24 to an even higher level for the full committee.

25 DR. WALLIS: Because if you talked about

1 just what you did today, I would suggest you use your
2 last three slides, that you give something like three
3 or four on the overview of your approach to things and
4 the design approach for this facility.
5 And then I found that these were
6 illustrated well by the individual topics. So I'd
7 have another three slides on things like red oil,
8 electrolyzer, HAN/hydrazine, control room habitation,
9 and fires, and seven times three is 21, which is about
10 what you need for an hour long presentation.
11 But I think it was useful to go into some
12 of the specifics of these individual phenomena as they
13 illustrated the approaches being used.
14 CHAIRMAN POWERS: Dr. Ford.
15 DR. FORD: I agree with Graham as far as
16 the recommendations for what to be given to the full
17 committee. However, I think I'd disagree with the
18 majority of this on the specifics. As I understand
19 it, we're being asked to endorse the case being made
20 for a construction permit, which includes the validity
21 of specific values -- and I'm quoting from here -- the
22 specific values and ranges chosen for the controlling
23 permitters in the design basis, and in order to
24 endorse those, you have to get into specifics.
25 For instance, on the red oil issue,

1 there's a set point of 125 --this is Slide 16 -- of
2 125 degrees Centigrade. For a runaway process it is
3 135. I'm unsure where the data associated with that
4 is, and what is the real margin between the data and
5 the runaway temperature? And what is the response
6 time for the system for a runaway process?
7 With regards to the HAN, Slide 23 and 25,
8 we have a temperature instability which is some
9 function of the nitric acid, et cetera, and hydrazine.
10 That's a mathematical value that is being given. I do
11 not know what the correlation between the data and
12 that mathematically derived set point is, and are
13 there any data -- question: are there any data
14 showing that you could have unstable performance below
15 the set point of the design basis value of 50 degrees
16 Centigrade?
17 It seems to me a lot of detail is being
18 left until you get to the ISA aspect. So generic
19 questions: what happens when you get all of this data
20 and you find those design basis values were
21 inappropriate and you change it?
22 As regards the full committee meeting and
23 things that Graham mentioned, I suspect that you might
24 get questions relating to quantification of the
25 frequency consequence diagram on Slide 11 in the

1 opening talk. It is entitled risk informing, 10 CFR,
2 Part 70, and I suspect you might well have questions
3 asked about the lack of use of PRA.
4 That's it. Thank you.
5 DR. DENNING: Dana, could we have just a
6 little discussion? Because I think that Peter's view
7 really is critical as to whether the ACRS can really
8 even support the approval for a construction permit
9 because if we have to do it at the level that you
10 talked about, if we really have to know whether the
11 125 degrees is correct today, you know, I don't think
12 we can do that, although perhaps we could, but we
13 certainly didn't look into it enough.
14 So I think the question is: exactly what
15 is the charter that we have? What is the ACRS really
16 going to approve? How far do we have to go? And, of
17 course, there's going to be judgment in that, but if
18 we really had to go as far as you said, if they had to
19 provide enough evidence to take us to that level, I
20 don't think they have done that, nor do I think they
21 can do it, and I think that this two-step process is
22 one where we have to accept the compromise that we
23 really aren't going to know, and there's going to be
24 a risk that the plant is going to get built, and it's
25 not going to satisfy the criteria.

1 So I think the focus has to be on the
2 criteria that is established. By that I don't mean
3 125, but just the general concept of the maximum
4 temperature.
5 DR. FORD: I agree with you entirely, but
6 I was taking my comments, taking verbatim from the
7 slides. It says what the purpose of the meeting was,
8 and it's to endorse this CAR for the facility, and
9 then it goes on to say which involves the design
10 basis, definition of the design bases, which on Slide
11 10 goes specifically into specific values and ranges
12 of values for controlling parameters.
13 So that's why I suggest that logical step.
14 Maybe I'm reading the criterion wrong, but taking it
15 from --
16 CHAIRMAN POWERS: I mean, I think you do
17 it within context here. You say the staff is really
18 asking is there anything wrong with our methodology to
19 evaluate these criteria, and in general most of the
20 criteria have been advanced by the applicant and the
21 staff is simply reviewing them in the face of some
22 uncertainty, okay, and the staff is asking us where
23 we've asked the applicant to do research to support
24 those numbers, was that the right decision, and when
25 we have not, was that a correct decision?

1 I don't think you're being asked to take
2 the way out of saying in the absence of perfect
3 information, I approve nothing. I mean, I think
4 you're being asked given the information that's
5 available, has staff taken a prudent course here, and
6 understand that one of the advantages of this facility
7 is that, of course, there is this plant that Vic talks
8 about that has operated for some number of years.
9 Some of these processes, for instance, the evaporators
10 of Hanford have operated for now 15 years using less
11 restrictive criteria than the staff has adopted.
12 So I see that as our charter, and not
13 saying, "Okay. Well, I have to have perfect
14 information."
15 DR. BONACA: I can give you an example of
16 why throwing the early design of the plants. I
17 remember commitment in the PSARs that you would have
18 a protection system that would give you protection
19 from over pressure transience so that you will never
20 reach in a PWR 2750 psi, and you have certain
21 assumptions about the functions you will use for that.
22 Therefore, I remember at Babcock & Wilcox
23 the function relied on was high flux and high
24 pressure, and then once you have begun to develop the
25 plant we found that you had a range of reactivity

1 insertion rates for which you had no protection. So
2 you had to implement a new function that you finally
3 found. I mean, it was in a flux as the core; you
4 implement some new element.
5 So there is no doubt in my mind that in
6 this process there may be some features that the
7 implementation process may require some modification
8 of that kind, but it seems to me it's more of a
9 refinement at that point than a general assessment
10 that says, yes, a protection system that will meet
11 certain requirements can be, in fact, implemented and
12 is acceptable in concert.
13 And I view this as a conceptual design
14 that says the approach is feasible.
15 DR. FORD: Well, I'm certainly not saying
16 that they have not identified the issues. I think
17 they have. All I'm responding to is what's on this,
18 what they're asking us to do, and if it's not what
19 they're asking us to do, fine.
20 But they do ask us to comment on the
21 specific values of the design basis parameters, and
22 even admittedly in the face of uncertainty. And you
23 take that into account in terms of adequate margins,
24 and so now I'm asking, well, how adequate is the
25 margin, and that's where I'm coming from.

1 Maybe I'm being too copious on what they
2 say they want us to do.
3 CHAIRMAN POWERS: Well, I mean, on the
4 specific issue, again, I caution that if they had put
5 up a slide that says, "Okay. Here's what the computer
6 code calculates and here are all of the data that
7 we've collected from a bunch of laboratory tests," it
8 wouldn't help me a bit because I know that it's almost
9 impossible to reproduce in the laboratory the
10 conditions that take place in the actual evaporator.
11 DR. FORD: So then you'd be more
12 conservative presumably.
13 MR. SIEBER: Not necessarily.
14 CHAIRMAN POWERS: I would tend to go back
15 to the empirical data that says, okay, where have the
16 evaporators been operating for 25 years successfully.
17 Okay. Well, sit in that range because, you know, they
18 work fine. I mean, that's my natural tendency, is to
19 do that.
20 I mean, I have not done this laboratory
21 research myself. I've held the hand of he who is
22 doing the laboratory research, and you can never
23 convince yourself that you were actually reproducing
24 the conditions in the --
25 DR. FORD: I drew up here a graph. This

1 is for the HAN process. These values here, 65 and 50,
2 are calculated. The points that are supposed to be
3 the experimental data points, all I'm asking is are
4 there red spots, i.e., denoting unstable behavior,
5 below that 50 degrees line which they say is an
6 adequate margin. That's all I'm asking.
7 CHAIRMAN POWERS: Well,w hat I will tell
8 you --
9 DR. FORD: And if there are, then it's no
10 longer a margin.
11 CHAIRMAN POWERS: I don't know the
12 database for HAN. I know more the red oil, but on the
13 specific limits there, there are none below what's set
14 as the DOE --
15 DR. FORD: Well, that's fine.
16 CHAIRMAN POWERS: There are absolutely
17 none. Never make it go there.
18 DR. FORD: Good for the rationalists or
19 are we structuralists? I'd love to see that graph.
20 Data compared with a mathematical derived model.
21 DR. WALLIS: Well, in the absence of that,
22 I'd like to know that the designers of the plant have
23 some other way of doing it. Maybe it's not this graph
24 but some other way that assures adequate safety, and
25 we never heard anything from the designers of the

1 plant.

2 I mean, that's a problem I have with the

3 documentation. I read your documentation and on the

4 red oil I was told that by controlling the temperature

5 of the residents with the organics, the off-gas system

6 and so on, you could get the red oil to be stable.

7 But I said, okay, the details must be in

8 the applicant's paper. So I go to the applicant's

9 paper, and the applicant says exactly the same thing.

10 There's no detail there. So in the absence of having

11 the designer up there confronting him with "what do

12 you mean by you can control the temperature. Show

13 me," there's no way I can get that reassurance.

14 Presumably you aren't the designer. So

15 who is it who knows the technology well enough to do

16 it right?

17 DR. RANSOM: Well, along those lines in

18 the red oil argument, they want to control

19 temperature, but actually temperature and pressure are

20 coupled, and they talk about open and closed systems,

21 and so your ability to vent this thing and regulate

22 the pressure is really coupled with the ability to

23 regulate the temperature, and there's no detail. I

24 don't know whether they can do it or not.

25 MR. SIEBER: When you vent, you remove

1 heat, and that's the strategy.

2 DR. RANSOM: Well, they actually argue

3 you're cooling by evaporative cooling, which means

4 you're boiling the liquid mixture, and if you increase

5 the pressure, you increase the vapor pressure of that

6 fluid, and so the boiling temperature goes up. So

7 they're all coupled together.

8 CHAIRMAN POWERS: And heat removal goes

9 down unfortunately.

10 Mr. Croff.

11 DR. CROFF: Mike covered it.

12 CHAIRMAN POWERS: Boy, you're efficient.

13 Jack.

14 MR. SIEBER: They have but one leader.

15 DR. WEINER: That's just our public

16 persona.

17 MR. ROSEN: It would be to follow their

18 example.

19 MR. SIEBER: I guess in my comments I

20 would agree with everybody, but as we went through

21 today, I kept thinking about how could you restructure

22 what you've said today in a way that I could better

23 understand it. Okay? And so I've been, as we've been

24 going on, writing down the elements of what I think a

25 person with the mental capacity to understand what's

1 going on here, but not an intimate familiarity with
2 the plant or the process or the licensing might have
3 prior to any discourse with the staff on the subject.
4 And it seems to me I think that there are
5 some areas of confusion. At least the ACRS deals 95
6 to 99 percent of its time with power reactors. It's
7 licensed under a different set of rules. The
8 processes that occur in power reactors are quite
9 different than they are in chemical plants or in
10 processing fuel or what have you. So I think that the
11 stage has to be set by, first, spending a couple of
12 minutes on the Part 70 two-stage licensing process.
13 Next, I think that one needs to explain
14 the overall process for the facility, you know, from
15 the time that it leaves the DOE part until it comes
16 out as pellets ready to go into a fuel assembly.
17 Okay, and in the process of doing that, I
18 think that it's important to describe what's a batch
19 process and what's a continuous process because it
20 makes a difference as to how the controls are
21 established, and the limits and the set points and the
22 degree of the hazard present when you know these kinds
23 of things. And a good part of this plant is a batch
24 process plant.
25 Then I would -- and I agree with Dr. Ford

1 in this area -- I would look at the various kinds of
2 issues of concern from a safety standpoint. Number
3 one, chemical safety, and I mean by that toxicity.
4 You know, if you go to a chemical supplier and you buy
5 a drum full of something, you get an MSDS with it, but
6 if you are the chemical processor, there's no MSDS,
7 and you have a lot of intermediate products in your
8 own process that have certain hazards to workers, off-
9 site people, and so forth.
10 I think those things need to be -- the
11 important ones need to be described in how they're
12 controlled, and you've talked about that today.
13 The second thing is process safety, which
14 is the red oil kinds of issues, and whether they're
15 mitigated against or prevented.
16 Third would be criticality safety, which
17 we haven't heard about yet, but I think I have some
18 concerns about it at this point, and we'll find out
19 tomorrow when we ask questions.
20 Fourth was radiation safety both for
21 normal operations, the workers inside the facility and
22 under accident conditions.
23 And lastly, but not least, fire
24 protection. It seems to me with all of these chemical
25 in there, this place is just aching to burn, so to

1 speak, and so fire protection becomes an important
2 issue.
3 And in dealing with each of these, I think
4 it's important to describe whether the strategy is
5 prevention or mitigation or both, and what controls
6 are established on each of these processes, each of
7 these areas that's built into the design that says I'm
8 going to avoid this by preventing it or I'm going to
9 have prevention, but in case I really don't prevent
10 it, here's some mitigation strategies, for example,
11 your ventilation system. So your ventilation is a
12 strategy for mitigation to me.
13 I think that you need in accordance with
14 Dr. Ford's explanation the data that says, for
15 example, in process safety: here's the stable region.
16 Here's the unstable region. And then you have to go
17 beyond that. How well do I know it? What's the
18 uncertainty?
19 Secondly, where am I going to establish my
20 process limit?
21 And lastly, how much margin is there and
22 does it encompass the uncertainty that I have in my
23 test data and in my ability to measure what's going on
24 in the process?
25 To me that would much more firmly

1 establish whether this plant is operated within the
2 safety parameters that the application bounds and that
3 the staff would like to assure. I think without that,
4 then we don't have all the technical pieces that it
5 takes to say, yes, this facility will meet
6 expectations with regard to safety impacts or, no, it
7 won't and these things need to be changed. You don't
8 have enough margin here. You need to lower this
9 process control variable, and so forth.
10 And I think if you set things up like that
11 and then establish really what integrated safety
12 analysis is as compared to what we all know as PRAs
13 and why it's good enough and in some cases for these
14 kinds of facilities, it's better than a PRA, and what
15 one hopes to establish by reviewing the ISA.
16 And I think that when you do that, that
17 sort of ties together all of the parameters and
18 control variables that you need to discuss to
19 establish a reasonable probability the facility can be
20 operated safely.
21 I don't know if you can fit all of that
22 into two hours, but that's what I'd try to do. You
23 have to talk fast. I mean, you've got to keep right
24 on going.
25 (Laughter.)

1 MR. SIEBER: But in any event, to me --

2 CHAIRMAN POWERS: You mean that they're to

3 ignore any interruptions from Professor Apostolakis?

4 MR. SIEBER: Right.

5 CHAIRMAN POWERS: Just tell him to shut

6 up?

7 MR. SIEBER: And my wife always gets

8 annoyed when I turn my hearing aid off. Perhaps that

9 would work for you.

10 (Laughter.)

11 MR. SIEBER: It does work for me.

12 In any event, to me that's what ties this

13 up in a package, and the presentations I think today

14 were good. A lot of effort went into them, but not

15 all of the elements were there that I felt I needed to

16 know to be able to say that this facility is a good

17 facility, it would be operated properly, and it

18 doesn't represent an undue hazard.

19 And I guess that's sort of the way I feel

20 about it, and you know, the application is very long

21 and the SER is a third the size or a fourth the size,

22 but it's also very long and neither say as much as I

23 would have liked them to say, and I guess you almost

24 have to wait for the sequel, which is the operating

25 license application, in order to find out --

1 MR. ROSEN: How does the story end.

2 MR. SIEBER: Yeah. No, what is the
3 background? What are all of the little parts. You
4 know, you make glorious statements. You know, we
5 aren't going to do this and we aren't going to do
6 that, and here's our limits, but you don't say how
7 you're going to do it, and until all of these design
8 details are there and a description of how you're
9 going to operate the facility, until that's there you
10 won't have every piece of the story that's necessary.
11 You can just say, "Okay. Here's some weapons grade
12 material. Let's make fuel out of it."

13 So anyway, that's sort of the way I feel
14 about it, and I think the elements are there. I think
15 the staff has done a really good job, and I'm
16 impressed with the effort that the staff has put
17 forward on this project, and I think that the
18 applicant has done a good job, too.

19 On the other hand, I think that we could
20 package it better, and for those unfortunate enough
21 not to be on the fuels subcommittee.

22 I don't know if the staff has any comments
23 or if I make any sense, but that's sort of the way I
24 feel about it.

25 CHAIRMAN POWERS: Dr. Weiner.

1 DR. WEINER: I just had one brief comment.
2 The slide that you have that showed that hazard matrix
3 highly unlikely and so on, first of all, that is an
4 area where you are showing that your analysis is risk
5 informed because that's exactly what that does.
6 I'd certainly make it clear what you mean
7 by highly unlikely, and so on, and I would add to it
8 the chemical hazard matrix. It's just a suggestion.
9 I think especially if you have members of
10 the public, less involved people present at the
11 hearing, that will mean something.
12 CHAIRMAN POWERS: Okay. Dave, you're up.
13 What do you think you ought to present?
14 MR. BROWN: Well, I wanted to also mention
15 the content of the letter.
16 CHAIRMAN POWERS: Yes.
17 MR. BROWN: You know, as pointed out, we
18 can fit all of that even into two hours. We'll have
19 to see, but you know, I think it's probably useful if
20 this is -- if you don't object, to put some historical
21 context in on this section of that regulation, the
22 7023(b). Where did it come from? How did it come to
23 be there?
24 It turns out that that section was added
25 in the early '70s with the specific intent in mind

1 that no one would build a plutonium processing
2 facility that could not be run. For example, you
3 wouldn't build a plutonium processing facility out of
4 concrete block with glass windows. That clearly would
5 not meet any strenuous seismic design criteria. You'd
6 end up having to tear the building down because you
7 couldn't get a license.
8 That was kind of the intent, and as you
9 said earlier, Dana, the struggle that the staff is
10 having with that regulation is, you know, have we
11 gotten adequate assurances that this plant if it's
12 built according to these design bases could be
13 operated safely, and we have made appropriate
14 judgments that some details can be deferred later
15 until the final design is completed; that in no case
16 would this plant have to be torn down to the ground
17 and rebuilt in order to get a license.
18 I think that's kind of, I think, a message
19 that I'd like to across.
20 CHAIRMAN POWERS: Yes, I think that's very
21 useful.
22 MR. BROWN: Okay. That's my boiling it
23 down to one point.
24 CHAIRMAN POWERS: Now, here's a man that
25 knows how to hone things down.

1 MS. WESTON: Dana, I'd like to weigh in on
2 this.
3 CHAIRMAN POWERS: God is speaking to me.
4 (Laughter.)
5 MS. WESTON: I'd like to weigh in on this
6 also. I think that it must be clearly articulated
7 that this is the design basis phase, and they need to
8 make clear to the committee what that means and what
9 the obligation is of the licensee with regards to
10 that.
11 I think that has led to a lot of confusion
12 about what is expected of the licensee. So I think
13 that really, truly has to be clearly articulated at
14 the full committee so that everybody understands what
15 the playing field is and what the licensee is
16 obligated to provide at this point based on the
17 regulations, which we can't change at this point.
18 Okay?
19 CHAIRMAN POWERS: Good point.
20 DR. RYAN: Let me pick up on that comment.
21 You know, as I walked in today, I'm thinking about
22 where are we in terms of percent complete. You know,
23 there's preliminary design, trial design, pre-
24 construction, and all of that, and it might help you
25 to lay out that time line, you know, in some way and

1 say, you know, we're here; we're not over here, and
2 just kind of get everybody oriented to what's going on
3 at this.
4 CHAIRMAN POWERS: Okay. That's very good.
5 DR. RYAN: That might be helpful.
6 CHAIRMAN POWERS: You're quite right. And
7 one of those standard diagrams that DOE uses in its
8 system engineering would really clarify things very
9 much.
10 Joe.
11 MR. GIITTER: I think something that would
12 be helpful, Dr. Powers, is if you started off the
13 presentation to the full committee by summarizing the
14 collective view of the subcommittee, you know, based
15 on what you're going to talk about subsequent to this
16 meeting, what you've talked about today, and I think
17 that will set a tone for us to step in.
18 And I agree with Mag's comments. I think
19 we do need to redouble our efforts to make it clear
20 that this isn't a reactor. This is a fuel cycle
21 facility being licensed under what was intended to be
22 a one-step process, a risk informed, performance based
23 process, and what we're doing here is something
24 different and unique, and that we're actually taking
25 this through two steps: a construction authorization

1 and then a possession in use license.

2 CHAIRMAN POWERS: I think that's a good

3 comment, Joe, and our ground rules even actually

4 prescribe that the subcommittee chairman is supposed

5 to give the full committee an appropriate background

6 for this.

7 And so I will suggest that Mag and your

8 staff work together to kind of create an outline of

9 what those comments should be, to put a context, and

10 I may carry a little water for you. I might use that

11 percent completion slide that Dave used just to

12 illustrate things.

13 I certainly would use the point that this

14 is the first application of the regulation and

15 whatnot, and maybe we can work together and come up to

16 a background that sets the stage appropriately for

17 you. That would fit well with the prescriptions that

18 are given to the subcommittee chairman for full

19 committee meetings, and I might use language that the

20 committee kind of expects to hear and avoid new

21 terminology for them just because it's familiar to

22 them.

23 So that's a good point.

24 Stuart, do you have any comments?

25 MR. MAGRUDER: Nothing.

1 CHAIRMAN POWERS: I can't believe it.

2 MR. MAGRUDER: It has all been said.

3 CHAIRMAN POWERS: Somebody has got a gun

4 to your head. I know this.

5 DR. WALLIS: Dana, could we go back to

6 this risk informed, performance based remark here? In

7 terms of the red oil, I think if this were risk

8 informed decision making we would want to say what is

9 the probability of a runaway reaction which led to a

10 breach of the vessel, and we would have to look at the

11 uncertainties in the measurement of the temperatures,

12 the chemical reaction rates, the stability criteria,

13 all based on some sort of rationale, and we'd have to

14 say now with this choice of 125 degrees and these

15 controls, what is our best estimate of the probability

16 of failure.

17 And without that, I feel I'm dealing with

18 something I can't get hold of. Now are you going to

19 get to that state some time?

20 MR. MAGRUDER: Yes. That hopefully is

21 what will be in the ISA.

22 DR. WALLIS: That sort of thing will be in

23 the ISA.

24 MR. MAGRUDER: Yes, absolutely.

25 DR. WALLIS: And they may say we were

1 wrong about 125 degrees. We should have picked 122
2 because that puts us within our criteria or something,
3 and we realize we are uncertain enough about the
4 reaction rates that we have to add some factor of
5 safety or margin or something. That will all be
6 there?
7 MR. MAGRUDER: Yes, it will. Well, where
8 they can quantify things it will be there.
9 DR. WALLIS: If it's as vague as it is
10 today, I'm not going to feel very secure.
11 MR. MAGRUDER: Hopefully you'll feel more
12 secure after you've seen the ISA.
13 CHAIRMAN POWERS: Yeah, I guess I am less
14 confident that a mechanistic understanding would come
15 about. I think if I had a vigorous interrogator
16 demanding quantitative information I would go
17 experiential.
18 I mean, I keep coming back to this all the
19 time. The system seems to be chemically complex.
20 More importantly, it seems to involve some cooperation
21 between radiolytic and thermal processes, which are --
22 I mean, we're still sorting out the radiolysis of
23 water. We are not going to solve the issues of
24 radiolysis of complex compounds promptly, and I have
25 to admit that I'm must more comfortable with

1 experiential bases than maybe someone who has a strong
2 bent toward mechanistic understandings.
3 DR. WALLIS: Well, that's fine, but what's
4 the bottom line? What do you use to conclude as a
5 criterion of acceptability?
6 CHAIRMAN POWERS: Well, I mean, the thrust
7 has always been, I mean, in many of these, many, many
8 processes, if I do it this way I'm okay.
9 DR. WALLIS: It has never failed before.
10 Therefore it will be all right. Maybe it's not a very
11 broad experience?
12 DR. BONACA: I think they provided the
13 criteria, however, for the example you're making.
14 They're saying process safety control subsystems. So
15 control reactivity enthalpy by limiting steam
16 temperature. Okay?
17 Now, when they would come up with detailed
18 design after construction, they would have to explain
19 how, in fact, they're achieving this.
20 And the next one is limit organic compound
21 residence time to oxidize radiation. That's the
22 criterion that they'll have to demonstrate physically.
23 I mean, what have you done to deliver on that issue?
24 I believe that you would use this as
25 criteria to compare to, right? To make the judgment

1 whether or not this is reasonable residence time.

2 MR. BROWN: That's right.

3 DR. BONACA: What happens if, in fact, you

4 cannot limit? Do you know enough about what does it

5 mean "limit residence time"? What's your expectation

6 on a jargon of that nature?

7 MR. BROWN: Using that as an example, we

8 know enough that the hydrolysis rates and radiolytic

9 decomposition rates are such, especially for weapon

10 grade plutonium with not a lot of fission products

11 present, are slow, and so that the order of magnitude

12 of the time involved here is months.

13 DR. BONACA: Okay.

14 MR. BROWN: And the solvent undergoes

15 regular washing at the end of the cycle. So that's

16 why we can say without specific information on those

17 rates it's reasonable that they can obtain clean

18 solvent using the sodium carbonate solvent washington

19 system.

20 CHAIRMAN POWERS: It may be that this

21 system is not even susceptible to red oil phenomenon

22 because it only has alpha emitters and there's no

23 strong gamma component to this. You don't have a lot

24 of cesium in this.

25 MR. BROWN: Yeah, we think it is

1 susceptible to red oil phenomenon in the hydrolysis
2 rates alone,b ut I understand your point.
3 CHAIRMAN POWERS: It could be. It could
4 be.
5 DR. BONACA: No, no. I agree that only
6 the most recent steps have been accomplished, but I
7 thought that the criteria have been put in place to
8 make a judgment once the facilities are constructed.
9 Now, it may very well be that what is being delivered
10 is not adequate, and that may be a judgment we pass at
11 that time.
12 DR. WALLIS: There seems to be an
13 assumption that if you control the steam temperature,
14 you can control sort of heat input. Well, I'd have to
15 see how that works. We have to know something about
16 how this head exchanger works and now it's controlled
17 and what the flow rates are and all kinds of stuff to
18 find out if it was really controllable that way.
19 And this idea of adding water and letting
20 it evaporate, again, you've got to calculate all of
21 that.
22 DR. BONACA: Yeah, it is, yeah.
23 DR. WALLIS: So there's a huge step of
24 faith that these methods will actually work.
25 CHAIRMAN POWERS: Okay. Well, I think

1 you've gotten the guidance repeatedly now that in your
2 presentation that some sort of overall setting the
3 stage, some discussion of the two-step licensing
4 period as a background, some description of the
5 facility itself, and then I would encourage you to use
6 the slide to illustrate the magnitude of your review.
7 I think there's a consensus there's a fairly
8 comprehensive review you've done.
9 Then a variety of technical issues come
10 up, and I would encourage you, again, to use these as
11 illustration of your approach, avoiding plunging into
12 too much details, but focus on how you went about
13 doing things and whatnot.
14 And, of course, you're stuck with roughly
15 an hour of presentation here. So I mean, I will try
16 to set it up so that you get forgiveness for just
17 listing some of the issues that you've gone into, and
18 then pluck a few out that you think you can make your
19 case clearly on that.
20 DR. DENNING: Dana, an hour's presentation
21 really seems totally inadequate to me. Is that cast
22 in stone? Should we be considering changing that?
23 CHAIRMAN POWERS: The ground rules, well,
24 we're certainly trying to get a three-hour block for
25 them, but in general, the planning and procedures

1 committee says that if you have to go much longer than
2 that, then you're really talking about a subcommittee
3 meeting and get your act together.
4 Okay. Now, we have an advantage there.
5 There are eight members here, plus we have the advice
6 and help from the ACNW. So, quite frankly, I am
7 sympathetic to the full committee's planning and
8 procedures committee that this thing ought to be
9 sorted out such that a presentation can be made that
10 they can evaluate a draft position that we bring
11 forward to them.
12 I mean, I think we ought to be able to do
13 that, and I will certainly be holding the time
14 schedule fairly rigorously on this. Now, if we get an
15 extra half hour, we get an extra half hour,b ut --
16 DR. WALLIS: And I think it would help,
17 from my experience of these planning procedures
18 committee, if we actually had something from the
19 subcommittee chair indicating how much time was
20 needed. Otherwise it just seems that we go with the
21 old formula and give everybody an hour and a half or
22 something.
23 It's quite clear that some issues take
24 longer than others when you're bringing the whole
25 committee up to speed or if there's much more material

1 or something. So maybe you could help guide the
2 planning --
3 CHAIRMAN POWERS: Well, let me remind you
4 that this will be the third time that the full
5 committee has been exposed to this material. I mean,
6 they're not virgins on this subject, and in fact, even
7 asking to go through the general purpose of the
8 facility is a little bit repetitious to the committee.
9 They've seen it before.
10 DR. BONACA: Well, I propose it only
11 because this has taken so long.
12 CHAIRMAN POWERS: Yeah, I mean, it's just
13 a reminder and things like that, and it's unusual. It
14 is an experiment, and it's a heroic amount of effort
15 on the part of the staff.
16 MR. ROSEN: And some important things have
17 changed.
18 CHAIRMAN POWERS: And some important
19 things have changed.
20 MS. WESTON: I have already requested
21 additional time.
22 MR. SIEBER: You need to use the
23 microphone.
24 MS. WESTON: Oh, I'm sorry.
25 CHAIRMAN POWERS: And identify yourself.

1 DR. RANSOM: Speak with sufficient clarity
2 and volume.
3 MS. WESTON: I said I've already requested
4 additional time. We'll see whether or not we get it.
5 John understands that we need more time than the
6 usual.
7 DR. WALLIS: It also depends on how much
8 the ACRS can influence the course of events or add
9 value to this whole process. From what I've seen
10 here, I'm not sure that we have --
11 CHAIRMAN POWERS: I can assure you that
12 we'll have a substantial influence on the commission's
13 vote.
14 DR. WALLIS: No, but I think that we're
15 likely to give them a blessing to go ahead and we're
16 going to say we're going to look at things later on
17 when we've got more detail. It isn't as if there are
18 some issues we want to weigh in on at the moment.
19 CHAIRMAN POWERS: No, I think I have three
20 of them, yeah.
21 DR. WALLIS: Well, if the committee has
22 got to weigh in on issues, then we need time to get
23 enough information.
24 CHAIRMAN POWERS: I think there are three
25 of them that we will certainly be exploring further.

1 Okay. I'd like to try to keep to the
2 schedule and move on to the DPO process. I again
3 can't say enough about the quality of the
4 presentations and the delivery today from those
5 specific topics you brought up, and I will comment on
6 reviewing the SER.
7 There are, of course, a number of things
8 I think you need to correct in there. It does bear
9 the nature of a draft. I will compliment you on it.
10 Much of the SER reverts to the familiar staff jargon
11 that says, "Gee, maybe we looked at this and it sounds
12 okay," and it didn't tell us how you looked at it, but
13 there are occasions in which you have done a good job
14 in explaining why you came to the conclusion, and I
15 thank you for every one of those, and don't take it
16 too hard for the numerous times you revert back to
17 the familiar jargon of "it looks okay to us."
18 And we'll be in communication as we try to
19 put this thing together, but I alert you that as the
20 members of the subcommittee get through more and more
21 of this material, it is entirely possible we may have
22 to get together again to chat about specific issues
23 when we don't understand them, and we do have two or
24 three here that we're going to go through, and we'll
25 talk about those a little bit tomorrow.

1 Otherwise I'd like to move on to the next
2 topic.
3 MR. BROWN: Thank you. Thank you for your
4 time.
5 CHAIRMAN POWERS: Thanks, Dave.
6 MR. MURRAY: If I could just have a minute
7 just to see if the copies have been finished, please.
8 (Whereupon, the foregoing matter went off
9 the record at 4:36 p.m. and went back on
10 the record at 4:38 p.m.)
11 CHAIRMAN POWERS: Okay. We're back with
12 Alex Murray.
13 MR. ROSEN: This will be interesting.
14 DR. WALLIS: Are you wearing a different
15 hat now, Alex, or is it the same hat?
16 MR. MURRAY: Yes.
17 MR. ROSEN: Is that crutch loaded?
18 MR. MURRAY: No. I only have one bit of
19 bad news. My pain medicine is wearing off.
20 (Laughter.)
21 MR. MURRAY: Thoughts of me going to a
22 higher quantum state. I apologize.
23 Well, let me begin. My name is Alex
24 Murray. I am the lead chemical safety reviewer for
25 the MOX construction authorization request. As I'm

1 sure everyone is aware of, I have expressed concerns
2 about potential safety issues at this facility
3 numerous times.
4 In November of 2003, I actually had, if
5 you will, a dissenting view which I presented before
6 the subcommittee, I believe it was, and now that we've
7 gone a little over another year and a review of some
8 new, additional information has been provided and so
9 forth, I wanted to give you an update on what my
10 thoughts are about where some of these safety issues
11 stand, and I want to emphasize that it is possible
12 that I may decide to pursue some of these safety
13 issues through basically the differing professional
14 opinion process, but I have not finalized any
15 decisions yet.
16 Now, I want to give you feedback in three
17 general areas. One is some comments on the safety
18 review process, some observations which I think you'll
19 find have been similar to some of the comments and
20 statements that the subcommittee members have
21 mentioned earlier today. I want to just comment on
22 some of the previously open items which were presented
23 today and then give a quick overview about DPVs and
24 DPOs.
25 Now, this is a two-step licensing process.

1 We've heard that numerous times. Step one is a
2 construction permit. Step 2 is a license application.
3 I do have a concern about the balance
4 between the two. How much can we defer to the license
5 application? How much should we look at and have now?
6 In some places I think we really need some
7 more information now, particularly when we're dealing
8 with commitments. All right. In a number of places
9 for the construction permit we, the staff, are
10 supposed to review the application for the
11 appropriateness of PSSCs and design bases. Okay?
12 In some places the commitments are that,
13 oh, well, we'll determine these, which seems to be
14 putting the cart before the horse, and I elaborate
15 upon that a little more in a moment.
16 I went through the regulations as regards
17 to commitments, and there was no clear statement which
18 even mentions commitments.
19 If I look at the safety guidance which is
20 primarily in the standard review plan, I note that
21 there's a comment that commitments may be acceptable.
22 A concern which I have with MOX is that in general,
23 you know, we have accepted PSSCs and design basis that
24 the SRP primary source of guidance would say we would
25 need more information on, and I have heard that

1 sentiment about the need for more information on PSSCs
2 and design basis mentioned by members of the
3 subcommittee here.
4 We also have accepted a number of items
5 which are not what we called RAGAGEP or good practice,
6 reasonably and generally accepted good engineering
7 practices, and I'm concerned that with some of those
8 we do not have an adequate basis for accepting them.
9 Okay. In particular, I note here about
10 relying on future efforts and experiments to define,
11 if you will, current PSSCs and design bases or better
12 define these PSSCs and design bases. In particular,
13 for red oil and HAN we have a commitment to future
14 experiments to basically fill in the blanks, and that
15 concerns me, concerns me greatly.
16 Now, I just want to mention very quickly
17 a couple of comments about diverse viewpoints. As a
18 member --
19 DR. WALLIS: Are you going to tell us what
20 some of the blanks are?
21 MR. MURRAY: Yes, in about five minutes.
22 Okay?
23 I just wanted to mention a little bit
24 about diverse viewpoints. This is what the staff haws
25 available as, if you will, processes for expressing

1 diverse viewpoints, and I just want to give, you know,
2 some observations.
3 For the most part I have found in raising
4 safety issues, safety concerns, trying to get some
5 resolution of safety issues and safety concerns, I
6 find that I either deal with it locally or it has to
7 go all the way to DPV/DPO. There's nothing in
8 between, and that's a concern.
9 Okay. Now, on the positive side, I do
10 want to mention that there are going to be a number of
11 internal staff workshops to try and address a number
12 of these concerns, particularly on the consensus
13 process. So all may not be lost, but again, you know,
14 these are some observations I have.
15 Now, we at the NRC, we are basically
16 stewards for the public, and I remember from one of
17 the public meetings that this statement was set, and
18 it struck a cord with me, and a couple of other
19 reviewers have picked up on it as well, namely, that
20 the NRC needs to act as a regulator and conduct
21 thorough safety reviews of the proposed MOX
22 facilities.
23 Now, I'm going to go in and just give some
24 feedback and comments on the previous open items. We
25 discussed these earlier on today, and also just to

1 remind you, these were items that I had a dissenting
2 viewpoint on at the November 2003 subcommittee
3 meeting, and you can, of course, read the titles of
4 all the issues there.
5 Now, red oil. Okay. We have discussed
6 this at length. As you know -- I'll show a picture in
7 a second -- there's a potential for significant damage
8 and release of radiochemical materials. This event
9 has happened.
10 Now, when we look at open systems, okay,
11 we have limited information provided by the applicant.
12 The staff went out, did a lot of digging, looked
13 through the literature, talked to people, did a lot of
14 reviews, and we came to the conclusion that this was
15 clearly acceptable because it is based on test data,
16 empirical data, but data nonetheless, and there was a
17 nice safety margin.
18 However, for closed system, we really had
19 no additional information from the applicant on the
20 docket. We found that this clearly contradicts some
21 of the Department of Energy and Defense Nuclear
22 Facilities Safety Board reasonably and generally
23 accepted good engineering practices.
24 And another concern is it is clearly in a
25 range which the department of energy has identified as

1 potentially unsafe.

2 I just want to point out why are we

3 concerned. This is in the public literature. This is

4 a picture of the Tomsk facility in Russia which

5 underwent a red oil event that involved potentially

6 less than 100 gallons of red oil, okay, organic

7 material. What is even more amazing is that the event

8 occurred in a shielded canyon below grade.

9 MR. ROSEN: And that wall blew out

10 obviously with -- what was it made of?

11 MR. MURRAY: This wall above grade is

12 simply a thin masonry with some reinforced concrete to

13 it. The canyon below it had a four foot thick shield

14 plug blown out.

15 MR. ROSEN: And it pressurized the space

16 behind that wall which blew out --

17 MR. MURRAY: Yes.

18 MR. ROSEN: -- towards the plane --

19 MR. MURRAY: That is correct.

20 MR. ROSEN: -- which was masonry and maybe

21 some reinforced concrete.

22 MR. MURRAY: Some four inch reinforced

23 concrete wall, but you get some idea. This was,

24 again, comparable quantities of organic materials

25 participated in this reaction, and comparable

1 quantities to what would be available at the proposed
2 MOX facility.
3 DR. WALLIS: This was since their runaway
4 reaction?
5 MR. MURRAY: Yes.
6 DR. WEINER: Is it thoroughly documented
7 with access to the documentation, whatever they could
8 figure out? Was it thoroughly documented, whatever
9 they could figure out of the parameters of the runaway
10 reactor?
11 MR. MURRAY: There are several reports and
12 documents on this. There is some interpretation.
13 MR. ROSEN: Can you make a guess about
14 what year it was?
15 MR. MURRAY: I think it was 1994, I
16 believe. It may be '93.
17 MR. SIEBER: Yeah, it wasn't too long ago.
18 CHAIRMAN POWERS: The Department of Energy
19 sent a relatively large review team out. They had
20 access to everything you have. It's like all events
21 of this type. You've got a bunch of junk. It was a
22 less than well instrumented test.
23 MR. MURRAY: Yes. Now, I just wanted to
24 point out you've seen this slide on the pressure vent
25 relationship before. Okay? I'll just point out the

1 open system is here: clear safety margin based on
2 capacity to the empirical test.
3 For the closed system, it's over here. I
4 have concerns about that. Okay? It concerns me that
5 the approach for closed systems I have to conclude
6 does not provide adequate assurances of safety at this
7 time. I have listed some of my concerns here. In
8 essence, it's a control of a single parameter,
9 temperature. The potential for common mode failure
10 effects, particularly with heat transfer and the vent.
11 I've heard a couple of the ACRS subcommittee members
12 mention something to that effect.
13 I'm very concerned about margin or
14 adequate margin. We have in a closed system a
15 situation, a chemical reaction situation where there
16 is less capability for venting and yet we, the NRC,
17 are willing to accept a higher temperature for the
18 reactions. It seems as if we're going the wrong way.
19 And I've also noted what's been discussed
20 here several times about uncertainties. Okay?
21 There's very little information on uncertainties. We
22 have little -- well, we have no calculational basis.
23 DR. WALLIS: How can we tell who's right?
24 MR. MURRAY: That is a good question.
25 DR. WALLIS: Because we have assurances

1 from one side and you've got questions from the other,
2 but without some technical data, we have no basis for
3 a decision.
4 MR. MURRAY: That is correct. As I state
5 here, I have no assurance that the quench system and
6 the 125 degree Centigrade limit has the ability to
7 prevent red oil reactions.
8 MR. ROSEN: Well, I think, Alex, you stole
9 my point. I think --
10 MR. MURRAY: Oh, I'm sorry. I'll give it
11 back to you.
12 MR. ROSEN: I pointed out on the slide
13 that there were no uncertainties. Uncertainties
14 weren't addressed on this 32 kilograms per square
15 centimeter number. Now, the way you deal with
16 uncertainties traditionally is margin.
17 MR. MURRAY: Yes.
18 MR. ROSEN: We establish lots of margin.
19 MR. MURRAY: Yes.
20 MR. ROSEN: So it's not like you can't
21 deal with it. It's just a question of --
22 MR. SIEBER: You have to define both the
23 uncertainty and --
24 DR. RANSOM: He's just pointing out the
25 vent area where the vent is not sufficient to bring it

1 back to the --

2 MR. ROSEN: But that's why I wanted to ask

3 you about your red dot way over there in the corner.

4 MR. MURRAY: Yes.

5 MR. ROSEN: Now, that's your view of how

6 much margin we need?

7 PARTICIPANTS: No, no, no.

8 MR. MURRAY: That is where the applicant's

9 proposed closed system resides on the vent diagram.

10 DR. WALLIS: It's a very small vent.

11 MR. MURRAY: It has a relatively small

12 vent. It is not capable of venting the reaction.

13 MR. ROSEN: But the number goes out to the

14 hundreds perhaps.

15 MR. MURRAY: I think it's around 200.

16 DR. BONACA: Could you explain to me the

17 difference of this approach to the DOE? Well, they're

18 talking about what you recommend. This seems to be an

19 approach which you suggest.

20 MR. MURRAY: Well, my suggested approach,

21 my recommendation is the Department of Energy runs

22 evaporators right now which has controls for

23 addressing red oil concerns. Their controls basically

24 focus on four parameters. So they have control of

25 multiple parameters. They generally have a good

1 branched control strategy on controlling temperature,
2 on controlling organic carryover, on controlling
3 concentration of the nitric acid, and I am controlling
4 the concentration of the organic material.
5 All right. So there are multiple
6 approaches to it.
7 DR. BONACA: So it is not that the
8 approach with DOE is to have larger vent. It's --
9 MR. MURRAY: One other control is the
10 Department of Energy uses that vent relationship just
11 to --
12 DR. BONACA: Does it move? Doe she move
13 it?
14 MR. MURRAY: On the same slide, the
15 Department of Energy uses vent relationships
16 approximately in this range.
17 DR. BONACA: Also for closed systems.
18 MR. MURRAY: They do not try and make a --
19 they do not try to distinguish between open and closed
20 systems.
21 DR. BONACA: But you are not aware of
22 closed systems used by DOE that have must vent area
23 beyond that point?
24 MR. MURRAY: No, I'm not aware of any such
25 situations, and that is the concern I have. I think

1 it's very appropriate that the applicant would put
2 forth what is, in essence, a new safety approach.
3 However, my recommendation, since we have no details
4 on this approach, we have no follow-up test data which
5 has been provided on this approach or calculations, my
6 approach would be, gee, you know, why don't we have a
7 permit condition which imposes the DOE/DNFSV good
8 practices, if you will, which are summarized in a
9 report which they put out last summer, and then at the
10 license application stage, the applicant can come
11 forth and prove their case for something different
12 when they have data.
13 DR. BONACA: Moving to this kind of
14 recommendation, would it have significant implication
15 to the physical construction of the equipment?
16 Because you refer to a number of process issues. I'm
17 asking now regarding physical characteristic of a
18 system.
19 MR. MURRAY: I would think, yes, event
20 size would be larger. There would have to be more
21 safety controls identified, yes.
22 DR. RANSOM: Is the differentiation
23 between an open system and a closed system just the
24 size of the vent?
25 MR. MURRAY: The differentiation between

1 the two systems is basically identified by the size of
2 the event, yes, okay, and an open system as defined by
3 the applicant is in accord with that venting
4 relationship. Okay. It can vent the full red oil
5 reaction if it were to occur.
6 DR. WALLIS: It would still be
7 pressurized. It's just that when it needs to vent, it
8 has a big hole open --
9 MR. MURRAY: But basically --
10 DR. WALLIS: -- open to the sky.
11 MR. MURRAY: Right. Basically it has a
12 big enough hole through the venting system, I guess in
13 this case an evaporator be the off-gas treatment
14 system, yes.
15 DR. RANSOM: Well, is it run at one
16 atmosphere then pressure?
17 MR. MURRAY: From the construction
18 application, the revised construction application, I
19 believe two of the evaporators are nominally
20 atmospheric pressure, and one is slightly under
21 vacuum. Oh, I just should say vacuum evaporator.
22 MR. SIEBER: But the venting occurs to the
23 environment, to the atmosphere?
24 MR. MURRAY: Through an off-gas treatment
25 system, ultimately through fans, and then ultimately

1 to the environment, yes.

2 MR. SIEBER: Right, not into a tank.

3 MR. MURRAY: No.

4 DR. BONACA: Why do you feel that this

5 approach of DOE would prevent the Tomsk red oil

6 explosion? I mean you present it as the picture of

7 the explosion right after the design presented here.

8 You just did it to indicate concerns with red oil

9 explosion, not necessarily because you think -- well,

10 also because you think that system is vulnerable to

11 that kind of --

12 MR. MURRAY: I think the Department of

13 Energy has gone through all of the information it has

14 from both its own tests, plus analyses of events like

15 Tomsk, and has come to a conclusion that if you

16 introduce these four types of controls and, if you

17 will, their design basis values, that the event is

18 rendered to be, using DOE terms, incredible, less than

19 ten to the minus six.

20 DR. BONACA: Okay.

21 DR. RANSOM: Why is that? Was the Tomsk

22 situation, for example, a closed system or

23 inadequately vented?

24 MR. MURRAY: Just very quickly, in the

25 case of Tomsk there were two vents. Okay? They both

1 were nominally one inch diameter. What happens, and
2 this happens at any vessel, because of the degree of
3 gas evolution, you essentially experience choked flow
4 as the gases try to get through the vent.
5 DR. RANSOM: So that basically it would
6 not be called an open system, I guess, then.
7 MR. MURRAY: That's correct.
8 DR. RANSOM: Okay.
9 MR. MURRAY: Okay. It could not relieve
10 the full red oil reaction, the gas evolution from the
11 full red oil reaction.
12 CHAIRMAN POWERS: But, Alex --
13 MR. MURRAY: Yes.
14 CHAIRMAN POWERS: -- the contention that
15 DOE makes that it has rendered the red oil phenomena
16 incredible is not the product of detailed kinetic
17 analysis and whatnot. I mean, it's mostly what you
18 would characterize perhaps as a plausibility argument?
19 MR. MURRAY: I would say it's an argument
20 based upon empirical data.
21 CHAIRMAN POWERS: Experiential data.
22 MR. MURRAY: Experiential data, exactly,
23 and thank you for using the word "experiential."
24 Yes?
25 DR. WALLIS: So it wasn't an incredible

1 response.

2 CHAIRMAN POWERS: Well, I understand Tomsk

3 involved a variety of situations that are not

4 typically encountered.

5 MR. MURRAY: There are a number of

6 controls which basically weren't followed at Tomsk.

7 They had them there. Some were influenced by

8 administrative procedures. There was a shift turnover

9 at the time, things like that.

10 Okay. Let me move on and --

11 DR. BONACA: But I guess the sense you

12 have is that, in fact, controls and procedures which

13 also the applicant is proposing can, in fact, fail,

14 and you need a mitigating feature, such as a large

15 event. Is it your fundamental point?

16 MR. MURRAY: These are my concerns.

17 DR. BONACA: Because, you know, when you

18 look at -- okay. No, you go ahead.

19 MR. MURRAY: These are my concerns, and

20 they include a concern about the adequacy of the vent.

21 In particular, this common mode failure and what

22 happens in the real world when you have vessels and

23 evaporators like this, you essentially hit a limit of

24 about 200 feet per minute with the vapors flowing out

25 where you have choked flow. It's a practical choke

1 flow limit, and you cannot get more material, more
2 gases through that vent until your pressure rises.
3 As your pressure rises, the normal boiling
4 point increases. As the normal boiling point
5 increases, the reaction rate increases. You get more
6 gas involved, and it starts running away.
7 DR. WALLIS: In feet per second or --
8 MR. MURRAY: I'm sorry?
9 DR. WALLIS: From 200 feet per minute is
10 not very rapid.
11 MR. MURRAY: But that's been if you're
12 going to look at evaporator design, for example --
13 DR. WALLIS: That would be in a two-phase
14 mixture that you can get that, but in a gas it's very
15 unlikely.
16 MR. MURRAY: Two-phased mixture is another
17 concern, yes.
18 Let me move on very quickly to
19 HAN/hydrazine, and as we discussed earlier today,
20 there are two cases, and one of the cases has been
21 modeled as a system of partial differential equations.
22 I just wanted to quickly show pictures of how powerful
23 this type of event can be.
24 This is from the Hanford event in 1997.
25 This was before the accident. This was afterwards.

1 Okay? About 25, 30 gallons of HAN were involved in
2 this event. Fortunately the people, personnel who
3 were in the area has left for lunch. Otherwise there
4 could have been serious injuries and/or deaths.
5 Now, I just want to quickly go over my
6 conclusions on these. I think the system of partial
7 differential equations' mathematical model is
8 fantastic. I love models; I love math. It's an
9 engineer problem I have. My family thinks I'm nuts.
10 Having said that, all we, the staff, have
11 done is we have checked the mathematics. That
12 concerns me. You know, we have relatively little
13 comparisons to actual data, and you know, if you start
14 looking at some of these software guidance that we,
15 the agency, have, we haven't followed it, and that
16 bothers me. How do we know we're getting two
17 reasonably good predictions from the system of
18 equations for, if you will, making a safety decision.
19 I also want to add that there is a
20 contradictory design basis with hydrazoic acid. Now,
21 you know, I think it's something that can be worked
22 out. I have a recommendation coming up in a moment,
23 but I'm concerned there.
24 Now, Case 2 actually concerns me more than
25 Case 1. Case 1 is where you're trying to prevent

1 decomposition. Case 2 is where you're trying to make
2 it happen. So you are going to have gas evolution in
3 I guess it was the October 2002 revision of the
4 application, the applicant had proposed a flow
5 control, active engineer control for the situation.
6 DR. WALLIS: What flow was being
7 controlled here?
8 MR. MURRAY: Basically the flow of the
9 reagents, the nitric acid, hydrazine.
10 DR. WALLIS: So it's flow control of every
11 reagent.
12 MR. MURRAY: Yes, or it can be a general
13 control on the total flow, essentially controlling how
14 much energy goes into that system.
15 Subsequently, in the revised safety
16 strategy which they submitted last October, I believe
17 it was -- I'm not sure of the exact date right now --
18 the applicant decided to remove that flow control or
19 that active engineered control, and they instead cited
20 standards which accommodate flow design, but not
21 active flow control.
22 And I'm concerned that, you know, we
23 essentially have a situation where we're missing a
24 control link.
25 And here I list my recommendations for

1 controlling HAN/hydrazine, and for Case 1 it needs to
2 be addressed soon. I think it could be addressed
3 before significant construction gets underway, perhaps
4 deliver the schedule.
5 On Case 2, I think the applicant and/or
6 the staff should consider putting that active
7 engineered flow control back in.
8 Let me move on. Electrolyzer. Now, this
9 is a good one. I had a lot of concerns about this
10 area, and I presented a dissenting viewpoint at the
11 November 2003 meeting, and I'll just mention here that
12 the applicant has proposed now what I would call a
13 much more robust safety strategy, and it incorporates
14 both active and passive engineered controls.
15 Also, the active controls turn off the
16 power. If you don't have electricity, you can't have
17 the initiator for the event, and my conclusion is
18 they've done a smart job there, and that has the
19 ability to meet the Part 70 requirements for
20 construction.
21 I just want to just very quickly mention
22 this just shows rough calculations by the staff and
23 the various scenarios, and you can see there's
24 potential for very rapid increases in the temperature
25 of the titanium given short in currents. That cannot

1 happen now with their proposed safety strategy.

2 Yes?

3 DR. WALLIS: Because it switches off

4 quickly enough?

5 MR. MURRAY: Yes, yes, exactly.

6 Just a quick comment about uranium

7 dioxide. Burnback, this is one of those strange

8 phenomena. It happens when you lease expect it and

9 when you don't want it to happen, and as you can see

10 here, the concern I have is if you use some of the

11 values that the applicant has stated can be involved,

12 you come I would say very close to the threshold for

13 damaging the filters, the HEPA filters, with the

14 material that has potentially passed through the

15 stainless steel pre-filters.

16 I think this is an easy one to fix.

17 DR. WALLIS: I was a bit curious about how

18 you filter such small particles using stainless steel

19 filters.

20 MR. MURRAY: Yes.

21 DR. WALLIS: What kind of a filter is it

22 that's stainless steel that can filter such small

23 particles?

24 MR. MURRAY: At one of the public

25 meetings, I believe it was the January 2003 one, the

1 applicant graciously brought in a sample of what they
2 were proposing, and I will say, you know, stainless
3 steel mesh type filters are quite difficult to make in
4 this range, but you know, there are some very capable
5 filter manufacturers out there. So, again, using the
6 criteria, I would say, yes, there's ability to
7 fabricate such filters.
8 And I think to adequately address this
9 concern, the applicant has stated there would be
10 intermediate HEPA filters. Right now none of those
11 are identified as safety controls. Elevating one of
12 those intermediate filters would address the concern.
13 Chemical limits, as I said, there are four
14 issues here. One I'll discuss in a moment as a
15 DPV/DPO; also, one related to dispersion modeling,
16 which I'll discuss as a DPV/DPO; and also
17 phenomenological modeling, and that is discussed and
18 addressed in the final safety evaluation report.
19 This discussion I'm just going to quickly
20 comment about the limits. I have three basic concerns
21 or areas of concerns. One is the staff's previous
22 findings have not been addressed. I've listed them
23 here.
24 Also, I have some concerns about
25 procedural issues. Okay? Unqualified staff made this

1 decision. You know, what are appropriate chemical
2 levels that do not involve people who have a
3 background in toxicology or in chemistry or biological
4 effects on chemicals? I have a concern about that.
5 You know, what credibility do we have as an agency?
6 And third --
7 DR. WALLIS: Were these management type
8 decisions or were they some something delegated to
9 unqualified staff members? How did it happen?
10 MR. MURRAY: A friend of mine, who is a
11 very good health physicist, was asked by management to
12 do a review and to make a recommendation. And as I
13 stated here, these values -- and we discussed these
14 earlier in the day -- they do tend to fluctuate a lot.
15 DR. WALLIS: I hope you don't examine all
16 of the qualifications of the ACRS.
17 (Laughter.)
18 MR. MURRAY: You guys have perfect
19 qualifications. Don't you know that?
20 Anyway, since time is short, let me keep
21 moving along.
22 CHAIRMAN POWERS: Could you go back to the
23 variations in TEELs? You have a line there that says
24 certain TEEL values have increased substantially.
25 MR. MURRAY: Yeah, yes.

1 CHAIRMAN POWERS: Would you tell me what
2 you mean?
3 MR. MURRAY: Over the four-year course of
4 the staff's review of the application, several of the
5 TEEL values for chemicals of concern have increased by
6 factors ranging from about five to about 20, if my
7 memory is correct.
8 CHAIRMAN POWERS: And could you maybe have
9 on the top of your head a couple of those that have
10 gone up?
11 MR. MURRAY: One that comes to mind is the
12 one for nitric acid. It approximately tripled from
13 about 25 parts per million up to about 68. These are
14 what I would call Level III values.
15 The values for hydrazine have also
16 changed. I think they have changed by more like a
17 factor of ten. It's detailed in the revised draft
18 safety evaluation report.
19 CHAIRMAN POWERS: My recollection, I could
20 be wrong, but I thought the TEEL for nitric acid was
21 originally based on the one for hydrochloric acid.
22 MR. MURRAY: I don't think so. I think it
23 was based on some actual animal data.
24 CHAIRMAN POWERS: Data.
25 MR. MURRAY: Okay? Okay. Just a quick

1 comment about habitability, and that was where I had
2 a dissenting opinion last November, and I will just
3 say that I think the proposed permit condition
4 addresses those concerns that I have.
5 Flammability issues. Okay. In this case
6 you heard a very good discussion that we have had, and
7 the staff had some concerns that the PSSCs, which the
8 applicant has proposed, might not function as intended
9 as interlocks. And we had a brief discussion on that
10 this afternoon, and the staff, we have basically
11 accepted the NFPA-69 as, if you will, the design basis
12 commitment, and if the applicant wants to pursue
13 interlocks, they need to provide the details in the
14 license application as to how they can perform the
15 safety functions. And I think that's a reasonable
16 approach.
17 Okay. Let me just quickly summarize
18 differing professional viewpoints and differing
19 professional opinions. Five DPVs have been filed so
20 far on this. There was a change in the DPV/DPO
21 process. If you have any questions, Rene Pedersen
22 from the Office of Enforcement is here, and after I'm
23 done, you may address any concerns on that process to
24 her.
25 I should add that two of the DPVs have

1 gone through the full process, and two panels
2 appointed by management essentially agreed with the
3 DPVs 100 percent. Okay. That's like hitting six
4 grand slam home runs in a baseball game, to use a
5 sports metaphor.
6 The concern I have was that the actions
7 and responses did not address these safety issues. So
8 I pursued both as DPOs.
9 This is just an observation on some of the
10 changes in the DPV/DPO process. Now, this is the
11 DPV/DPO on chemical consequences, and in it, I
12 expressed concerns about chemical releases which are
13 regulated by the Nuclear Regulatory Commission.
14 The applicant has stated that the
15 likelihood of this event is not unlikely. The
16 applicant has also stated that radiation doses are
17 received. However, the applicant has also stated that
18 these releases are not regulated by the NRC because
19 they are below 7061 performance requirements.
20 Now, I want to point out that these types
21 of events, or at least one of them, has the potential
22 for multiple fatalities for operators outside the
23 emergency control rooms.
24 Now, I am not alone. I work on a team,
25 and I try and help people out as much as I can and so

1 forth. I want to point out that other members of the
2 staff have done assessments and have found that in the
3 case of one of the chemicals, nitrogen tetraoxide, you
4 can have very high concentrations at 100 meters. At
5 1,500 milligrams per cubic meter, that is almost like
6 a red fog, all right, no visibility.
7 Other members of the staff have concluded
8 that that would be immediately incapacitating and
9 fatal. All right? My assessment is, yeah, I tend to
10 agree with that. The estimated concentration could be
11 higher because we have a nuclear facility with a lot
12 of shielding, controlled access, security
13 requirements. That facility design will exacerbates
14 the hazard, and even though there are safe havens at
15 the proposed facility, they are not identified as
16 PSSCs to protect people, and given the magnitude of
17 this event, it is unlikely that they could reach those
18 safe havens or exits. They're trapped. As they're
19 trying to get out, the release would be sucked in.
20 Now, I show this as an example of a
21 chemical release of nitrogen tetraoxide. Okay. This
22 is from one of the Titan II silos. I believe it was
23 in the early 1970s.
24 The key point about this: the evaporating
25 surface area in this silo is about comparable to the

1 evaporating surface area from a spill, a potential
2 spill of N_2O_4 at the proposed facility.
3 Also, this is being released 126 feet
4 below ground. Also, the fluid was chilled. It also
5 required evacuation of a town two and a half miles
6 away. Two people were killed in this event from the
7 chemical release even though they had full suits.
8 At the proposed facility at the present
9 time, there is no safety requirement for protection
10 for any members of the facility against this type of
11 hazard.
12 MR. ROSEN: The two people who were killed
13 were members of the crew of that silo?
14 MR. MURRAY: That is correct. They had
15 what they called rocket handling protection suit.
16 DR. RANSOM: Were the amount of N_2O_4
17 comparable?
18 MR. MURRAY: The amounts of N_2O_4 present
19 at that facility were greater. The evaporating
20 surface area was about the same. The evaporating
21 surface area is key part to the release, if you will,
22 the source term, I should say.
23 CHAIRMAN POWERS: You mentioned the N_2O_4
24 was chilled, and I'm wondering does that -- I mean,
25 the fact that it's chilled, does that enhance its off-

1 site consequences or reduce them?

2 MR. MURRAY: It would depress them, okay,

3 lower vapor pressure, less of a release.

4 CHAIRMAN POWERS: Well, what I'm thinking

5 is the dispersal is less as well. Okay? I mean, if

6 it's hot, you get a buoyancy effect.

7 MR. MURRAY: Un-huh. I know what you're

8 talking about.

9 CHAIRMAN POWERS: And whereas if it's

10 chilled, it tends to hug the ground. I mean, the

11 molecular weight is higher than that of air.

12 MR. MURRAY: Right, right.

13 CHAIRMAN POWERS: It ends to remain

14 concentrated. You just don't have the buoyancy

15 effect.

16 MR. MURRAY: Right, right. It can travel,

17 be dispersed like a heavy fog.

18 DR. WALLIS: Why does it seem to be a

19 plume in this picture if it was chilled? This picture

20 of yours --

21 MR. MURRAY: I'm sorry?

22 DR. WALLIS: -- it seems to be a plume

23 going up, isn't it?

24 MR. MURRAY: Ultimately it is starting to

25 go up, yes. Now, this was taken at a distance from

1 the facility.

2 DR. WALLIS: Some source of heat there or

3 something?

4 MR. MURRAY: What tends to happen with

5 N_2O_4 is it undergoes a dissociation reaction as it

6 heats up, and that gives some more dispersion to it.

7 So it can both hop the ground. It can move over

8 things as it disburses, go back to the ground.

9 DR. WEINER: We had a very similar

10 incident in Colorado in the very early 1970s. There

11 is an explosives factory near Colorado. It's sort of

12 between Colorado Springs and Denver, and they had a

13 chilled N_2O_4 release that most of it just simply went

14 up the stack and kind of rolled down the side of the

15 stack, but what got up to the top got picked up by the

16 wind. There are down mountain winds there, and you

17 saw a very similar kind of pattern.

18 CHAIRMAN POWERS: Mike and I think that a

19 lot of the disbursal here may be coming because you're

20 interacting with moisture and water and turning into

21 acid, and that should be an exothermic reaction that's

22 giving you the heat.

23 MR. MURRAY: Let me just continue here.

24 I just restated what the DPV panel found, and I'm a

25 little bit concerned that some of the actions by the

1 office and division didn't really address the concern,
2 and I ultimately pursue this as a differing
3 professional opinion.
4 Now, there has been a draft report
5 generated on that, and this report I understand it's
6 supposed to be revised and put out late December,
7 early January. This report stated that no further
8 action is needed.
9 DR. WALLIS: What's this chilling effect
10 you're referring to on page 34?
11 MR. MURRAY: I asked staff if they'd be
12 willing to sit on various DPV or DPO panels, if they
13 wanted to be involved in discussing some of the
14 issues, and privately other members of the staff,
15 senior members of the staff, they agreed with me, but
16 they would not want to be involved with, if you will,
17 raising safety issues or being on DPV panels because
18 of concerns about their career. And it was based upon
19 what they saw happen in response to the DPV panel
20 report.
21 Okay. Now, just to finish off, taking a
22 little more time -- I apologize. I'll be quick --
23 this report was very interesting in that it did say
24 the safety issue was addressed and no further action
25 was needed, and it stated it that way because the

1 panel concluded the applicant has made blanket
2 commitments without exception to multiple codes and
3 standards which have habitability requirements for
4 occupied structures.
5 In addition, they looked at the baseline
6 design criteria for chemical safety and that
7 habitability is implied as part of that BDC, and the
8 applicant has stated in their revised application that
9 they intend to follow that baseline design criteria.
10 So what I would conclude from that is,
11 therefore, the applicant is required to maintain
12 habitability in all structures at the proposed
13 facility. In other words, they have to address the
14 chemical release event.
15 And I'll just quickly summarize about the
16 DPV/DPO on chemical modeling, and you can read this
17 slide. This is just a quick summary of the situation.
18 Oh, interesting. These computers never
19 cease to amaze me.
20 My concern is that, you know, we all love
21 chemical, we all love mathematical and computer
22 models, but no V&V has been done for the use of this
23 model for the specific site of the proposed facility.
24 In other words, the model output has not been compared
25 to, if you will, tracer studies at Savannah River,

1 simple terms.

2 CHAIRMAN POWERS: I wonder. It seems to

3 me that one of the -- I think the most recent ANS

4 meeting, in fact, there was a comparison of dispersion

5 models applied to the Savannah River site, and for the

6 life of me I cannot remember whether ARCON was part of

7 that comparison, but it might be worthwhile to go look

8 at it.

9 MR. MURRAY: Would that be in some of the

10 ACRS --

11 CHAIRMAN POWERS: ANS. If I said ACRS, I

12 misspoke myself.

13 MR. MURRAY: ANS. I'm sorry.

14 CHAIRMAN POWERS: The recent meeting at

15 ANS, I'm almost certain there was a paper on comparing

16 several dispersion codes for the Savannah River site,

17 but I can't attest to you whether ARCON was one of

18 them, but my recollection is the paper was quite

19 interesting because the author was very frank in

20 assessing the ease and applicability of the codes.

21 Okay. If I can find that paper, I'll

22 certainly pass it back to you.

23 MR. MURRAY: We will be very interested.

24 CHAIRMAN POWERS: I may be able to find

25 the author easier than the paper.

1 MR. MURRAY: Okay. That would be fine.
2 My E-mail is axm2@nrc.gov. Call me.
3 CHAIRMAN POWERS: Yeah, I will look at
4 that, and like I said, he may not have looked at ARC,
5 but he looked at several of them and found -- and he
6 goes through which ones are useful and not.
7 MR. MURRAY: Yes.
8 CHAIRMAN POWERS: He was definitely not
9 looking for this facility. He was looking at a
10 tritium release as his base case.
11 MR. MURRAY: Okay, okay.
12 MS. WESTON: I might also suggest that you
13 could, depending on the model you use, you can get
14 variations over a factor of ten, and I might also
15 suggest that you try to or have somebody try to solve
16 the equation, apply the Gaussian equation analytically
17 to see what kind of answers you get, look at an
18 elevated release, look at a stat kite (phonetic), and
19 so on, under various conditions.
20 If you'll give me a call or send me an E-
21 mail, I can give you some guidance on that.
22 MR. MURRAY: Okay, okay. That would be
23 very good.
24 And as I said, I did pursue this as a DPO
25 because there are some safety significant impacts from

1 this, and let me just show you some of my concerns
2 here graphically.
3 At the proposed facility, the applicant is
4 using a wind speed 95 percent meteorology of 2.2
5 meters per second. So about where these two red hours
6 are.
7 This is a model data comparison, and as
8 you can see, there's quite a bit of spread there.
9 Which number do you pick?
10 Right now the applicant's value, if my
11 memory is correct, is approximately around here.
12 MR. ROSEN: Isn't the most conservative
13 value a lower value?
14 MR. MURRAY: That is correct. The most
15 conservative value would be somewhere down here. That
16 is correct. What is reasonably conservative -- I
17 don't know -- somewhere around here.
18 CHAIRMAN POWERS: Well, I mean, I don't
19 know of anybody that really uses Murphy-Campe anymore
20 for chi over Q.
21 MR. MURRAY: Yeah, that correct.
22 CHAIRMAN POWERS: I mean, Murphy-Campe is
23 a way of correcting the chi over Q to account for
24 building wake effects, and I don't know of anybody
25 that's using Murphy-Campe anymore.

1 MS. WESTON: Also, if you do a joint
2 frequency distribution for wind speed, you usually get
3 a speed around four or 4.5 meters per second, which
4 puts you out a little further.
5 MR. MURRAY: Right, right. And again, you
6 know, we would expect as you get below about four
7 meters per second wind speed that you would have some
8 more variability because of eddies from the phenomena,
9 but I think the question is very valid. Which value
10 do you use for licensing?
11 And this is another comparison with data.
12 Again you see a fair spread there. Again, which value
13 should we pick as providing adequate assurances of
14 safety?
15 DR. WALLIS: You've got data here. You
16 didn't show us any data on red oil or how much it
17 scatters.
18 CHAIRMAN POWERS: No, this is a model-
19 model.
20 DR. WALLIS: No, I know, but I was going
21 back to another issue there and if there was any data
22 talked about.
23 MR. MURRAY: Well, when we were discussing
24 red oil, that's my concern.
25 Okay. Let me continue on here. The DPV

1 panel, as I stated essentially agreed with it, agreed
2 with the DPV. What I found out was that several of
3 the responses, the actions which were taken to address
4 the DPV panel findings did not seem to be in alignment
5 with the report itself.
6 Now, let me just mention I did appeal this
7 as a DPO, and again, I have three main points there.
8 The information has not been verified and validated as
9 per, you know, the NRC normal operating approach with
10 software. No adequate quality assurances, and I
11 believe the safety issues still remain.
12 Now, I did just this week receive a copy
13 of the DPO report, and basically the DPO appeal has
14 been denied, and this implies verification and
15 validation for site specific application of the model
16 is not needed, but I'm still reviewing that report.
17 DR. RANSOM: Well, this is all an internal
18 NRC procedure; is that right?
19 MR. MURRAY: For these models, yes.
20 DR. RANSOM: And the panel is put
21 together. They're all from within the NRC?
22 MR. MURRAY: All from within the NRC, yes.
23 DR. RANSOM: And who makes the final
24 decision when you said it was denied?
25 MR. MURRAY: In the case of the PPO

1 appeal, it's by the EDO. In this case there was no
2 additional panel formed.
3 Okay. Let me continue on since time is
4 marching onwards. There has been a DPV, which I
5 submitted on waste management concerns. Now, I've
6 heard several people here express concerns in the area
7 of waste management. I share some of those concerns,
8 and I want to emphasize that my concerns relate to the
9 NRC regulated entity at the facility, and I've listed
10 the concerns here.
11 Now, I will say this is the DPV that no
12 one seems to want to touch. I don't know why. You
13 know, I know waste is a four-letter word, but still
14 you know, I really don't understand what has happened
15 here.
16 In the end, after over 12, 13 months, I
17 was told that the DPV was denied because waste is
18 under DOE jurisdiction, even though I am just focusing
19 on the open issues which the staff had in the original
20 draft safety evaluation reports.
21 CHAIRMAN POWERS: The issue that's been
22 raised here is one that it's waste, to be sure, but
23 it's waste actually on the MOX site.
24 MR. MURRAY: That is correct.
25 CHAIRMAN POWERS: I mean it's before it's

1 going to cross the boundary.

2 MR. MURRAY: That is correct, before it's

3 going to cross the boundary. That is correct, yes.

4 CHAIRMAN POWERS: That's not under DOE

5 control.

6 MR. MURRAY: On the other side of the

7 boundary -- well, the waste, before it goes over the

8 boundary, is under NRC jurisdiction. Again, before we

9 can send it over the boundary, it has got to meet

10 something, some requirement for the Savannah River

11 site. Otherwise it doesn't go. It stays in the NRC

12 regulated entity, and that's the concern I have.

13 DR. WALLIS: And eventually shuts down the

14 plant.

15 MR. MURRAY: Right. Again, you know, what

16 do you do? Shutdown requirement; well, you know, is

17 that something that we specify now or is that

18 something that is specified later?

19 I am of the opinion that it's something

20 that we need to have some closure on now.

21 MR. ROSEN: Well, don't you know the tank

22 sizes for the waste?

23 MR. MURRAY: Yes.

24 MR. ROSEN: Well, isn't that the shutdown

25 requirement? I mean, obviously they're not going to

1 overfill the tanks, are they, until the rooms fill up?

2 CHAIRMAN POWERS: I mean, I think Alex is

3 coming from a different point of view here, is that

4 the NRC has a societal obligation not to let a

5 facility run to fill up some tanks with waste.

6 MR. MURRAY: Right.

7 CHAIRMAN POWERS: I mean, that's pretty

8 clear from the Atomic Energy Act that thou shall not

9 do that, but --

10 MR. ROSEN: Perhaps, but there's a clear

11 limit established. Things will fill up, and that will

12 be the end of it.

13 CHAIRMAN POWERS: Sometimes establishing

14 these waste acceptance criteria has been

15 extraordinarily slow. Does SRS have a WAC?

16 MR. MURRAY: At the present time, as I

17 understand it, for the proposed DOE facility which

18 would accept this waste, no WACs have been defined.

19 CHAIRMAN POWERS: Yeah. I would not be at

20 all surprised.

21 MR. MURRAY: Yeah. Not even some general

22 type WAC.

23 CHAIRMAN POWERS: Yeah. Those things are

24 -- I mean it doesn't obviate your point at all, but I

25 was just establishing the ground rules because it

1 takes forever to get these WACs set up.

2 MR. MURRAY: That is correct. That is

3 correct, and I just want to mention that I have

4 forwarded my concerns to the ACRS/ACNW and asked do

5 you guys want to review this area, and I have not

6 heard anything back.

7 MR. ROSEN: Just this one, the waste.

8 MR. MURRAY: That's correct.

9 CHAIRMAN POWERS: You forwarded it to

10 someone besides me. I know that.

11 MR. MURRAY: Yes.

12 CHAIRMAN POWERS: Because I've not seen

13 it.

14 MR. MURRAY: It's all right. It's all

15 right.

16 CHAIRMAN POWERS: So I can't respond to

17 you.

18 MR. MURRAY: Yes, yes. I'm just

19 mentioning that.

20 CHAIRMAN POWERS: Did that come to you?

21 DR. BONACA: Came to you later on.

22 CHAIRMAN POWERS: No, I have not. Nothing

23 has been forwarded to me.

24 DR. WALLIS: It went into the waste

25 stream.

1 DR. RYAN: I did see it.

2 MR. MURRAY: Oh, you have seen it?

3 DR. RYAN: I did, yes.

4 DR. RANSOM: All right. That's what it

5 was.

6 CHAIRMAN POWERS: It's Mike that's slow.

7 You're the bad guy.

8 MR. MURRAY: You got it. You got it.

9 Okay. Very good. Thank you. So it will not be

10 orphaned forever.

11 Let's see. DPVs and chemical limits and

12 flammability. I just want to mention these have been

13 delayed for something like ten months, and they're

14 still rattling around in the system, so to speak, and

15 again, one of my union friends went ahead and filed a

16 grievance on this to say this is nuts.

17 MR. ROSEN: What does this "asked for

18 resubmission" mean?

19 MR. MURRAY: For one of the DPVs I was

20 asked to resubmit it. I said, well, it's in the

21 system. Why isn't it being reviewed, you see?

22 Anyway, let me just give a very quick summary.

23 I see that they're both a process, safety

24 review process, as well as specific safety concerns

25 that I have. I'm not quite sure how strongly I feel

about some of these. There is a potential for more DPOs. I haven't decided yet, but I say to everybody involved, both members of the staff at the NRC and members of the applicant, some of my colleagues and friends from the Department of Energy, we need to do our job, a good job, and address these safety issues and put a nice, little, holiday Christmas bow on top of it so that it's all addressed, and in that way we'll have discharged our public duty.

Thank you very much. If you have any questions, please let me know.

CHAIRMAN POWERS: Any questions posed?

DR. WEINER: Oh, my question. I just wanted to commend you for a very thorough discussion of this, and it seemed to me that, first of all, the point made about modeling is one that is near and dear to me. Models need to be, when possible, validate against data, not just against another model, and that is used sometimes.

I think that I get he impression tha the applicant would need to amplify the open system description and to thoroughly defend with some detail any use of a closed system. It seems to me you can do that defensibly. Other than that, I made the point about the Gaussian dispersion codes.

1 And I might also point out Gaussian
2 dispersion codes do not handle the near field well.
3 They blow up close to the source. We're confronting
4 that problem now in a number of instances, and that's
5 one reason I suggested trying an analytical solution,
6 because you can play around with what happens in the
7 near field.
8 CHAIRMAN POWERS: There's a very nice
9 model, very nice; there's a useful model that LANL has
10 come up with for the near field area.
11 DR. WEINER: I've seen it.
12 CHAIRMAN POWERS: Yeah, they developed it
13 actually for the Hanford tanks, and it seems to work
14 reasonably well. I mean, again, the problem with
15 these field dispersions is that you don't have a great
16 deal of data to compare against, but I mean, they did
17 an adequate job with that.
18 And the nice thing is that it's useful for
19 heavier than air dispersance.
20 DR. WEINER: We had one called HAZCON that
21 was floating around Sandia a while ago. It's a very
22 complicated model to use, but it does handle heavier
23 than air gases. We used it for chlorine emissions,
24 which is a nice example of heavier than air.
25 But I think the LANL model may be

1 available. You may be able to get it through the Web.
2 MR. MURRAY: Okay.
3 CHAIRMAN POWERS: Any other questions?
4 DR. RANSOM: Are we going to hear anything
5 more on these issues from the NRC?
6 CHAIRMAN POWERS: That really is part of
7 the DPV process, and we're kind of out of that loop
8 until a disposition is made and whatnot.
9 DR. RANSOM: I get the impression
10 that's --
11 DR. BONACA: The question that I have is
12 that we are asked to make a determination regarding
13 this SER, and for example, the red oil, I am not --
14 two sides of a story, and I don't have the judgment on
15 that issue.
16 CHAIRMAN POWERS: Rene, you wanted to say
17 a word to us?
18 MS. PEDERSEN: Well, I want to let you
19 know that I'm available if you have specific
20 questions, and I, again, commend Alex for coming forth
21 and letting his safety concerns be heard.
22 I've just been assigned as the acting
23 differing professional opinions program -- what a
24 mouthful -- program manager since August. Back in
25 June the program was transferred to the Office of

1 Enforcement. so this is somewhat of a new program to
2 us, and we're trying all that we can do to address
3 some of Alex's specific issues, but more importantly,
4 we're trying to address the issues that individuals
5 have expressed with this program in general.
6 One of the concerns that we've heard from
7 multiple review panels that have reviewed this program
8 since, you know, many, many years is that people are
9 afraid of using the program for fear of retaliation,
10 and clearly that's not acceptable in this agency.
11 In our office, we're trying to get the
12 message out that raising safety concerns, raising
13 concerns is not just a right, but it's a
14 responsibility. We want employees to come forward.
15 That doesn't mean that management is going to agree
16 with all of the concerns that you raise, but clearly
17 management has a better ability to make an informed
18 decision when all of the information is brought
19 forward.
20 What I would like to do is not to go into
21 all of the specifics that Alex has raised on his
22 issues. I just want to clarify a couple of points, if
23 I may. Alex has identified that he's raised five
24 DPVs, and indeed, Alex has raised five DPVs. DPV is
25 not formally accepted into the system until after it

1 has been reviewed by the staff, given a DPV or DPO
2 tracking number, and put into the system.
3 Of the five issues that Alex has raised,
4 two of the issues have been accepted into the system.
5 Two of the issues have been returned, and in a
6 memorandum to Alex that I had issued back in
7 September, I had encouraged Alex that if he still had
8 concerns with two of these issues, they were returned
9 because they were viewed as premature. In other
10 words, the staff had not established a position at
11 that time.
12 Coming into the position new, I felt
13 Alex's pain in the delays. There's no doubt that this
14 has not been a timely process thus far, but I
15 encouraged Alex that if he had remaining concerns, to
16 please file a DPO under the new program. We no longer
17 have DPVs. We have DPOs. We have informal
18 discussions, formal submittal of a DPO, and then a DPO
19 appeal process.
20 So at that point in time I encouraged and
21 I would encourage everybody if they have a safety
22 concern to please file it under the new DPO program,
23 which is on line, and the issue is on Informs. You
24 know, we love our forms in the agency.
25 The final issue that Alex has raised is he

1 had expressed a concern on waste, and this issue was
2 raised all the way to the level of the EDO. This
3 issue was rejected and basically not included, not
4 adopted as a DPV because it was outside our
5 jurisdiction.
6 So while Alex has raised these concerns,
7 I want to make sure that it's clear that these issues
8 are not rattling around in the system because they
9 haven't been adopted. Three of the issues have not
10 been adopted into the system.
11 Who of them very well could be and, again,
12 I would encourage Alex if he has these ongoing
13 concerns to please file them in the new program.
14 MR. MURRAY: I'll just make a comment on
15 that if I could, please.
16 I obviously disagree and so does the NTEU,
17 and that's why the three grievances.
18 Thank you.
19 CHAIRMAN POWERS: I'll bet they get to
20 revisit the waste issue. Just guessing.
21 Well, thank you very much, and unless
22 members have any questions.
23 (No response.)
24 CHAIRMAN POWERS: Okay. Well, what we're
25 going to do tomorrow is we're going to go into this

1 criticality business, and the only reason it's
2 tomorrow is the speaker is available tomorrow and he
3 was not available today.
4 And, gain, we will get a report from Dr.
5 Diamond up at BNL on his examination of the
6 criticality materials. I think he has specialized
7 expertise in these areas, and he can help us better
8 understand that.
9 We will probably include in that
10 discussion of the criticality this interface between
11 fire protection and criticality at least so we can
12 understand how it was handled a little bit because
13 that's one that's been rattling around here a little
14 bit on this, and we need to understand the role of
15 these fire suppressant systems a little better because
16 we have multiple experiences in the reactor community
17 with the Halon and whatnot being great at suppressing
18 fires, but they don't extract heat, and so you just
19 get back into the fire situation every time air
20 becomes available again.
21 Once those discussions are over, what I
22 really want to do is to spend some time discussing an
23 outline of the letter. I think we are stuck with
24 producing a fairly lengthy letter here, and so I think
25 it's worth our while to spend some time thinking about

1 the outline.

2 Staff has done a very comprehensive

3 assessment of a complex facility in a new exercise,

4 and it's going to be new to the Commission, and so

5 we've got to, I think, produce an equally extensive

6 letter in order to address this.

7 Now, that's just my thought. We can

8 debate that issue, and I'll remind you that the

9 committee used to in the early days accept entire

10 reactor systems with a glib phrase, something like,

11 "This facility can be operated without undue risk to

12 the public health and safety," for entire reactor

13 systems.

14 So it would not be without precedence

15 writing a short letter, but I think we're stuck here,

16 and so I think we need to go through it and identify

17 what points we want to make or we think should be

18 made, and what points we need to at least put on the

19 outline until we've had a chance to review things more

20 thoroughly.

21 DR. WALLIS: Can't we write a letter that

22 says the staff has done thus-and-so and clearly we're

23 not convinced?

24 CHAIRMAN POWERS: Sure, absolutely,

25 absolutely.

1 DR. DENNING: Can we write one that says
2 we're not convinced, but it's -- I'm concerned we
3 haven't heard from the applicant. I mean, you know,
4 it seems to me there are clearly unresolved issues as
5 far as we're concerned. The question is I think that
6 to a large extent the risk here is one of the
7 applicant.
8 The applicant has to recognize that they
9 could build a facility that might require major
10 renovations, and I could see where the DOE might be
11 under tremendous stress to move forward with this
12 because of international agreements and stuff like
13 that. They may very much want to move forward.
14 I'm saying too much because I don't know
15 what words they would tell us if they came, but
16 shouldn't we hear from them as to whether they're
17 willing to accept some risk that they may have to
18 modify the facility after it's constructed?
19 MR. ROSEN: Is that really our job?
20 DR. DENNING: Well, see, here's the
21 problem that I have, is just how far do we have to go.
22 We're definitely not going to hear enough to say this
23 facility is going to be a safe facility. We know
24 that. So the question is: how far do we have to go?
25 And we could even have some serious

1 reservations and still say if the applicant wants to
2 proceed, you know, we're going to examine this thing
3 later and have our comments later.
4 CHAIRMAN POWERS: Well, right now we
5 really had not -- I mean, the applicant has come in
6 and described its facility, submitted his CAR. We've
7 gone through that. Right now I had not planned to go
8 through more of that material on it. It is not -- I
9 mean, our job is to advise the Commission on what we
10 think about this work and where we have reservations
11 about what has been done and whatnot. I mean, we'll
12 give them our best judgment.
13 So I don't know that having DOE come in
14 and say what risk they're willing to accept would be
15 anything to change our judgment on it. I mean, we're
16 trying to send some advice to the Commission on this,
17 and it is a technical judgment that we're supposed to
18 offer, and if we have reservations, we need to lay
19 those out in spades and quite clearly.
20 Yeah, I mean, and this is multi-faceted,
21 and they quite likely will say, "Okay. This part is
22 good and this part we were a little bit concerned
23 about and this is parts that we have great big
24 concerns about." We've got to say that, too.
25 I certainly have four issues here that I

1 think will show up that will involve technical
2 discussion to establish positions on. I think there's
3 no control. I mean, I don't think there are any
4 surprised people. It's this control and emergency
5 response and planning, fire protection criticality,
6 safety, waste hand-off interruption issue,
7 habitability, and the chemical control limits.
8 MR. ROSEN: What was the last one, Dana?
9 CHAIRMAN POWERS: Habitability issues,
10 what issues we send. It seems to me that we spent
11 what seemed like altogether too much of my life
12 looking at the Reg. Guide 1.78 on control room
13 habitability, and the focus of that was precisely on
14 these limits, and I think the committee should have a
15 consistent position on that unless it makes a
16 conscious decision to deviate from that consistent
17 position.
18 MR. ROSEN: The issue is exactly the same.
19 CHAIRMAN POWERS: Oh, yeah.
20 MR. ROSEN: It's protection of human life.
21 CHAIRMAN POWERS: That's exactly the same
22 position. I mean, there's just no difference here.
23 And it sounds to me like the demands on the operator
24 are almost consistent here.
25 I mean, it just seems to me we ought to

1 have a consistent position.

2 Well, at any rate, so I'll invite you

3 tonight to think seriously about what items. I don't

4 want to write text tomorrow, and the outline is

5 exactly that. It is simply an outline. Things can be

6 added to it; things can be deleted from it. It's just

7 an outline, and you can put things on it that says, "I

8 want to put this point on here, but I want to go back

9 and reread the material and think about it in light of

10 what I have -- and I may adjust what I want to say."

11 I mean, that's perfectly fair. I would

12 rather have something on the outline than to get

13 surprised later during the debate. It's far easier to

14 delete than it is to add within the committee.

15 That's not to say that the ACRS doesn't

16 have the right to add things to our outline, but I

17 want to come in with a fairly complete outline, and we

18 will go, for the members that are interested, we will

19 go until about noon, and you're guaranteed it's over

20 by one o'clock because I have a separate meeting at

21 one o'clock on the research program. So we'll

22 definitely come to an end prior to one o'clock.

23 Any other comments people would like to

24 make?

25 (No response.)

1 CHAIRMAN POWERS: Well, in that case, I
2 suggest that we recess for the night and we'll resume
3 tomorrow at 8:30. I thank all speakers and all
4 participants. It was thoroughly enjoyable.
5 (Whereupon, at 5:54 p.m., the subcommittee
6 meeting 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 Reactor Fuels Subcommittee

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Rebecca Davis
Official Reporter
Neal R. Gross & Co., Inc.

DB

NRC Review of the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility

David Brown, Project Manager
Mixed Oxide Facility Licensing Section
Division of Fuel Cycle Safety & Safeguards
Office of Nuclear Material Safety & Safeguards

Outline of Introduction

- Purpose of this presentation
- Brief overview of the MOX project
- Regulatory framework for construction authorization
- Overview of project milestones
- Future project schedule

Purpose of this Meeting

- Purpose of this meeting is to seek ACRS endorsement of the staff's evaluation of the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility

MOX Project Overview

- September 2000 – U.S. and Russia agreed to each disposition 34 metric tons of surplus weapon grade plutonium
- The Department of Energy 's National Nuclear Security Administration, Office of Fissile Materials Disposition, is responsible for all activities relating to managing, storing, and disposing of surplus fissile materials.

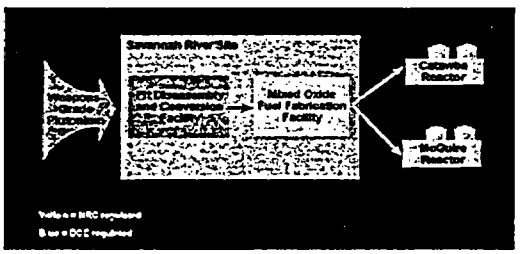
MOX Project Overview

- The National Nuclear Security Administration (NNSA) selected Duke Cogema Stone & Webster to design, build and operate the U.S. Mixed Oxide Fuel Fabrication Facility.
- In April 2002, the NNSA decided to disposition all 34 metric tons of U.S. surplus plutonium by irradiation of mixed oxide fuel in commercial nuclear power reactors.

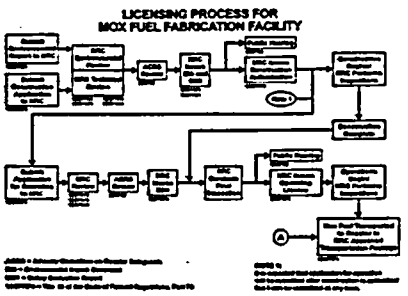
MOX Project Overview

- NNSA will construct two adjacent facilities at the Savannah River Site near Aiken, SC, to support the Surplus Plutonium Disposition Program
  - Pit Disassembly and Conversion Facility
    - Includes the Waste Solidification Building
  - Mixed Oxide Fuel Fabrication Facility

MOX Project Overview



MOX Regulatory Framework



MOX Regulatory Framework

- Two approvals needed for plutonium facilities:
  - Construction Permit
  - License to possess and use licensed material
- Construction Permit - 10 CFR 70.23(b)
  - A safety assessment of the design bases of principal structures, systems, and components (PSSCs)
  - Description of the quality assurance program
  - Environmental impact statement - 10 CFR 70.23(a)(7)

MOX Regulatory Framework

- 10 CFR 50.2 Definition of Design Bases:
  - "Design Bases means that information which identifies the specific functions to be performed by a structure, system, or component of a facility and the specific values or ranges of values chosen for controlling parameters as reference bounds for design..."

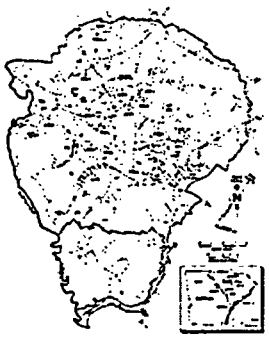
MOX Regulatory Framework: 10 CFR 70 Risk-Informed Regulations

	Highly Unlikely	Unlikely	Not unlikely
High Consequence Publ Dose > 25 rem Worker Dose > 100 rem	Acceptable	[illegible]	[illegible]
Medium Consequence Publ Dose 5 - 25 rem Worker Dose 25 -100 rem Env releases > 5000 Tbl 2	Acceptable	Acceptable	[illegible]
Low Consequence Publ Dose < 5 rem Worker Dose < 25 rem	Acceptable	Acceptable	Acceptable

MOX Project Milestones Construction Authorization

- Construction Authorization Request (CAR), Environmental Report and Quality Assurance Program Plan submitted to NRC by February 2001.
- First draft Safety Evaluation Report (SER) in April 2002 with 56 open items.
- Revised CAR in October 2002, after NNSA decision to cancel Plutonium Immobilization Project.
- Draft EIS issued by NRC in February 2003 – no significant impacts
- Second draft SER in April 2003 with 19 remaining open items
- November 2003 – ACRS meeting with 11 remaining open items; NNSA announcement of new Controlled Area Boundary

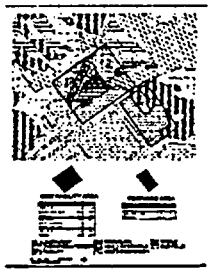
Controlled Area Boundary



- First CAB encompassed almost entire Savannah River Site
- CAB was 800 square kilometers
- CAB would now be < 0.06 square kilometers

New Controlled Area

MOX facility is located adjacent to the proposed Pit Disassembly and Conversion Facility



MOX Project Milestones

- CAR change pages received by NRC in June 2004
- Applicant made few MOX Facility changes resulting from Controlled Area Boundary change
- Safety assessment change attributed to change in CAB
  - Process Cell Exhaust System is included in the set of facility principal structures, systems, and components (PSSCs).

MOX Project Milestones

- Other changes in the June 2004 CAR include:
  - Removed uranium oxide dissolution system – replaced with uranyl nitrate system
  - Added Waste Organic Solvent unit
  - Updated chemical inventory list
  - Revised waste stream volume estimates
  - Other PSSCs added as a result of open item closure
    - Red oil, use of TEELs, and uranium bumback
  - Other editorial changes and corrections.

MOX Project Future

- If the SER is approved and the CAR is granted in February 2005;
  - NRC will start construction inspections and exercise enforcement authority
  - DCS will file a License Application and Integrated Safety Analysis Summary
  - Other license application documents will be filed
    - Facility Security Plan
    - Fundamental Nuclear Materials Control Plan
    - Emergency Plan, if required

Open Item Status

- Presenters:

Alex Murray, Senior Chemical Process Engineer

Bill Troskoski, Senior Chemical Engineer

Rex Wescott, Senior Fire Protection Engineer

Chris Tripp, Senior Nuclear Process Engineer

FSER Open Item Resolution Since November 2003: Chemical Safety Review Area

Alex Murray
Lead Chemical Safety Reviewer
NMSS/FCSS/SPB/MOFLS

Overview

* Discuss closure of open items from staff's RDSER (April 2003) and November 2003 ACRS Meeting

- CS-01: Red Oil
- CS-02: HAN/Hydrazine
- AP-03: Electrolyzer /Titanium Fire
- MP-01: Uranium Bumback
- CS-05b: Chemical Limits/TEELs
- CS-10: Control Room Habitability
- CS-09, AP-02, AP-06, and AP-09: Flammability

* *Provide summary*

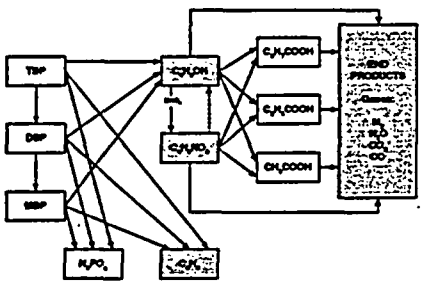
CS-01: Red Oil Introduction

- Aqueous Polishing uses an optimized PUREX solvent extraction process
- Generally two phases:
  - Aqueous: concentrated nitric acid (10-13.6 N)
  - Organic: Tributyl phosphate and branched dodecane mixture
- Nitrated TBP/organic compounds form
- Collectively termed "red oil" for the mixture

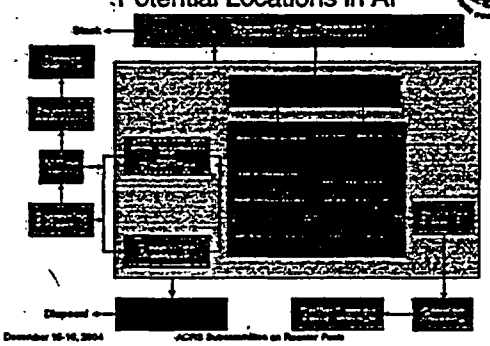
CS-01: Red Oil
Spectrum of "Red Oil"

The solution on the far left is the normal organic phase containing U and TBP. The far right is the material recovered following an overpressurization event. Color is dependent mainly on amount of heating and the type of hydrocarbon diluent employed.

CS-01: Red Oil
Sample Pathways and Intermediates



CS-01: Red Oil
Potential Locations in AP



CS-01: Red Oil

Safety Issue

- Red oil species can undergo exothermic reactions, involving small quantities (< 100 gal)
- Reactions can "runaway" and overpressurize vessels

- Several incidents (e.g., "knocking")
- Several accidents with significant equipment damage and release of radionuclides

CS-01: Red Oil

Applicant's Safety Approach

- Applicant has identified this as a high consequence event
- Selected a preventative strategy to render the event highly unlikely

- Safety controls:
  - Original application: 1 PSSC with 1 safety function
  - RCAR June 2004:
    - 3 PSSCs with 5 safety functions
    - commitment to further research and experiments

CS-01: Red Oil

Applicant Definitions

Two red oil cases:

- **Open Systems:**
  - Vent provided – pressure relief
  - No overpressurization from full runaway reaction
  - Can contain 100% organic compounds
- **Closed Systems:**
  - Vent provided – pathway for evaporative cooling
  - Cannot prevent overpressurization from full runaway reaction
  - Can contain substantial – but not 100% - organic compounds

CS-01: Red Oil

Applicant's Safety Controls (I)

PSSC#1: Offgas Treatment System

- Provide venting/avoid pressurization
- Allow path for evaporative cooling
- Open system: avoid pressurization
  - 0.008 mm^2/g organic (12.5 kg/cm^2)
- Closed System: evaporative cooling
  - 1.2 times [energy input from steam + reaction enthalpy]

CS-01: Red Oil

Applicant's Safety Controls (II)

PSSC#2: Process Safety Control Subsystem

- Control reaction enthalpy by limiting steam temperature (to 133 C)
- Limit organic compound residence time (exposure) to oxidizers and radiation
- For closed systems, use aqueous phase addition to:
  - Limit solution temperature to 125 C
  - Limit maximum heatup rate of 2 C/min

CS-01: Red Oil

Applicant's Safety Controls (III)

PSSC#3: Chemical Safety Controls:

- Ensure no cyclical organic compounds in diluent

CS-01: Red Oil

Applicant Commitment

Further research and experiments to:

- Define reaction kinetics
- Determine effects of impurities
- Establish operational limits and setpoints

CS-01: Red Oil

FSER Evaluation/Conclusions

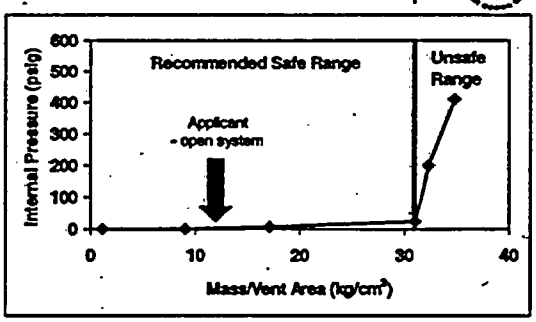
Open Systems:

- Preventative strategy acceptable
- Multiple PSSCs and safety functions
- Offgas (vent) PSSC design basis well within DOE experimental safety range (12.5 versus limit of approx. 32 kg/cm2)
  - System cannot pressurize
  - Physicochemically limited to not exceed NBP of azeotrope (120.4 C)
- Below red oil runaway conditions
- Accepted by staff

NBP = Normal Boiling Point

CS-01: Red Oil

Pressure Vent Relationship



CS-01: Red Oil

FSER Evaluation/Conclusions

Closed systems:

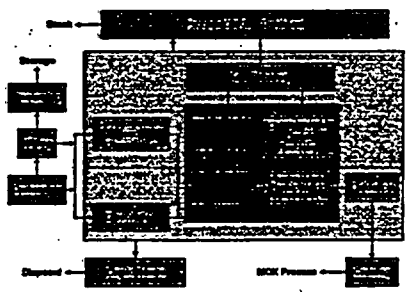
- Solution temperature not to exceed 125 C
  - 5 C margin below DOE safe initiation limit
  - 9-12 C below recent SRS test runaway initiation temperatures
- Organic exposure and diluent selection controls
  - prevent participation of other species (butyl)
  - avoid initiation temperatures below 130 C
- Temperature ramp control limits runaway enthalpy effects
- Aqueous phase addition and vent provide for evaporative cooling (20% margin) that limits temperature
- Applicant commitment to further research and experiments
- Accepted by staff

CS-02: Hydroxylamine Nitrate (HAN)/Hydrazine - Introduction

- Aqueous Polishing uses an optimized PUREX solvent extraction process
- A dilute nitric acid solution containing Hydroxylamine Nitrate (HAN) and hydrazine is used to reduce the extracted Pu(IV) to Pu(III) in the pulsed stripping column.
- This transfers (strips) Pu(III) into the aqueous phase
- A similar nitric acid/HAN/hydrazine solution recovers unstripped Pu in the last stage of the plutonium barrier.
- (Plutonium Barrier is to remove the last traces of Pu in the solvent prior to solvent regeneration).
- Hydrazine both stabilizes the HAN and reduces some Pu(IV).

CS-02: HAN/Hydrazine

Potential Locations in AP



CS-02: HAN/Hydrazine

Safety Issue

- HAN a reactive chemical
  - can undergo rapid autocatalytic decomposition
  - Nitrous acid/nitric acid reactions
  - Large quantities of gas evolved, pressure excursions
- Multiple events and accidents in industry
  - Hanford
  - SRS
- Involved quantities comparable to proposed MOX facility

CS-02: HAN/Hydrazine

Applicant's Safety Approach

- Applicant has identified this as a high consequence event
- Selected a preventative strategy to render the event highly unlikely
- Safety controls:
  - Original Application: partial application of DOE recommendations
  - Revised approach involves multiple parameters and controls

CS-02: HAN/Hydrazine

Applicant Definitions

Safety strategy focuses on prevention for two areas:

- Case 1: Vessels with HAN/hydrazine, no NO_x addition
  - Avoid decomposition reactions
- Case 2: Vessels containing HAN/hydrazine, with NO_x addition
  - Induce decomposition to avoid recycle and accumulation

CS-02: HAN/Hydrazine

Applicant – Case 1 Analyses

- Developed kinetic model based upon multiple reaction mechanisms (5 PDEs)
- Used kinetic parameters from the literature
- Solved model using commercial software
- Predicted regions of stability and safety design basis limits
- Applicant committed to confirmatory testing to substantiate the model

PDE = Partial Differential Equation

CS-02: HAN/Hydrazine

Applicant Controls for Case 1

PSSC	Safety Function	Controlled Parameter	Design Basis
PSCS (control system)	Maintain temperature below limit	Temperature	50°C
Chemical Safety Controls	Maintain NO_x flow limit	[illegible]	[illegible]
[illegible]	Maintain concentration [illegible]	[illegible]	[illegible]
[illegible]	Maintain HAN [illegible] below limit	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

CS-02: HAN/Hydrazine

Staff Analysis

- Reviewed literature equations
- Developed and exercised similar model
- Found:
  - Regions of stability
  - Regions of instability
  - Margin in proposed design bases

CS-02: HAN/Hydrazine

Staff Analysis of Case 1 DBs

Controlled Parameter	Design Basis	Stable Value	Margin (%)
Temperature	<50°C	<63°C	13°C (25%)
HNO_3	<6.0 M	<7.1 M	1.1 M (18%)
Hydrazine	>0.1 M	>0.018 M	0.082 M (550%)
HAN	<2.5 M	All stable	N/A
FIN	0 M	N/A	N/A

CS-02: HAN/Hydrazine

Applicant Controls for Case 2

PSSC	Safety Function	Controlled Parameter	Design Basis
Other System	[illegible]	Heat transfer [illegible]	UCA [illegible] codes
Chemical Safety Control	Limit HNO_3 [illegible]	HNO_3 [illegible]	UCA [illegible] codes
	Limit [illegible]	[illegible]	UCA [illegible] codes
	Limit [illegible]	[illegible]	UCA [illegible] codes
	[illegible]	[illegible]	UCA [illegible] codes

CS-02: HAN/Hydrazine

Staff Conclusions

Case 1: No NOx

- Model and literature predict stability
- Commitment to confirmatory testing
- Acceptable for construction

Case 2: With NOx

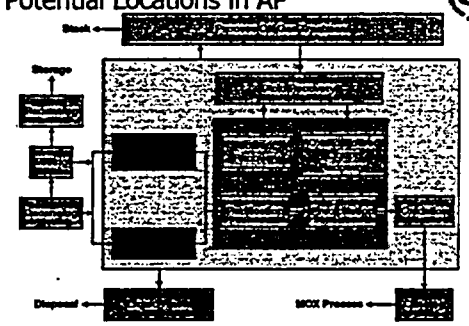
- Codes/standards consistent with industry, RAGAGEP
- Code methodology leads to DB values/ranges
- Acceptable for construction

RAGAGEP = Reasonably And Generally Accepted Good Engineering Practices

AP-03: Electrolyzer/ Titanium Fire - Introduction

- Purification requires dissolution of PuO_2.
- Dissolution can be difficult for some oxides
- Applicant selected electrolytic process based upon DOE/PNL program and Cogema use
- Electrolysis generates Ag[II], which dissolves PuO_2, circa 30 C, 6 N HNO_3
- Titanium used for corrosion resistance to Ag[II]

AP-03: Electrolyzer/Titanium Fire Potential Locations in AP



AP-03: Electrolyzer/Titanium Fire Safety Issue

- Titanium is a reactive metal
- Normal conditions: large currents and presence of oxygen (in HNO_3, oxides)
- Electrical fault could initiate titanium reactions (conditions exceed welding)
  - Planned fire protection may be ineffective, exacerbate situation due to Ti reactivity
  - Ti event would be difficult to predict and mitigate

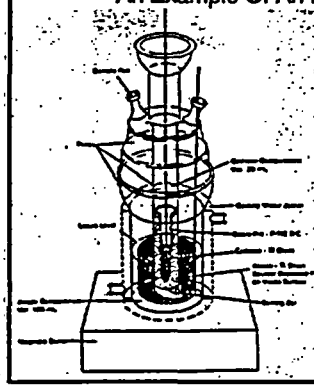
AP-03: ELectrolyzer/Titanium Fire

Applicant's Safety Approach

- Applicant has identified this as a high consequence event
- Selected a preventative strategy to render the event highly unlikely
- Safety controls:
  - Original application: no controls
  - Revised approach involves passive and active engineered controls (PECs/AECs)

AP-03: Electrolyzer/Titanium Fire

An Example Of An Electrolyzer



Key Attributes:
- Cylindrical geometry
- Center cathode and compartment
- Porous frit/barrier
- Annular anode and compartment
- Electrical connections
- Gas ullage and connections
- Insulators
- Means for agitation, cooling
- Silver[II] generated in anolyte

[from DOE/PNL experimental studies]
[Applicant's design would likely have more metallic components]

AP-03: Electrolyzer/Titanium Fire

Applicant's Safety Controls

Controls identified for:
- Maintenance/shutdown
- Seismic Event during operation
- Electrical fault during operation

AP-03: Electrolyzer/Titanium Fire

Controls During Maintenance

- Administrative controls
  - Isolate (terminate) power
  - Other requirements in procedures in License Application (LA)
- Staff Evaluation/conclusion:
  - Administrative controls RAGAGEP (Reasonably And Generally Accepted Good Engineering Practice, e.g., DOE, NFPA)
  - Other details in LA OK
- Acceptable for construction

AP-03: Electrolyzer/Titanium Fire

Controls during Seismic Event

- PSSC#1 is electrolyzer structure
  - Resist seismic events
  - Withstand turbulent flow
  - Not induce vibrations
  - Maintain geometry for criticality purposes
- PSSC#2: seismic trip system (part of PSCS)
  - Isolates power to electrolyzer during seismic event

AP-03: Electrolyzer/Titanium Fire

Staff Review of Seismic Event

Staff notes:

- Two independent controls
- Low frequency of seismic events
- Termination of power prevents Ti event
- Combination should have the ability to render event highly unlikely
- Acceptable for construction

AP-03: Electrolyzer/Titanium Fire

Controls for Electrical Fault

Passive Engineered Controls (PECs):

- PSSC#1: Sintered frit/barrier (Si_3N_4) – separates the anode from cathode in nitric acid
- PSSC#2: PTFE – separate anode from cathode and anode from ground
- PSSC#3: Guide sleeves – separate anode from titanium shell

AP-03: Electrolyzer/Titanium Fire

Controls for Electrical Fault (cont)

Active Engineered Controls (AECs):

- Current leakage detection system – shut down if > 10 mA
- Rectifier Trip Circuit: shut down if > 420 A
- Both part of PSCS (control system)
- No other related information (experience, references, codes etc.) provided

AP-03: Electrolyzer/Titanium Fire

FSER Conclusions

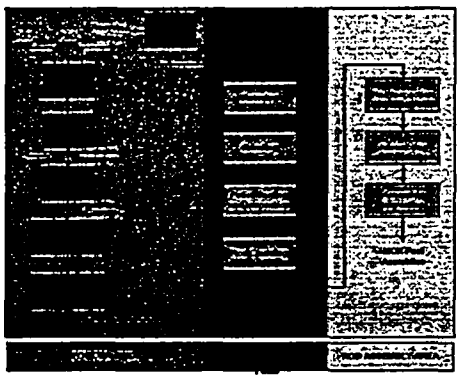
- Analyzed as top-level fault tree
- Used generic information from SRS, INEEL, codes
- Found combination of PECs and AECs capable of achieving highly unlikely
- AECs also RAGAGEP
- Conclude it is acceptable for the construction authorization

MP-01: Uranium Burnback Introduction

- Depleted UO_2 used as the matrix in MOX
- MOX requires blending of fine PuO_2 and (Depleted) DUO_2 powders
- UO_2 thermodynamically unstable under normal conditions
- "Burnback" refers to unexpected oxidation of uranium dioxide powders, e.g., on HEPA filters

MP-01: Uranium Burnback

MP Location



MP-01: Uranium Burnback

Safety Issue

- Burnback reactions can achieve high temperatures quickly
- Burnback can initiate other reactions/fires, disperse radioactivity, breach confinement, and damage HEPA filters
- Main concern is ball-milled DUO_2 powder ready for blending with PuO_2
- Such fine (< 10 micron) powders can burnback in exothermic reactions starting at room temperature

(HEPA = High Efficiency Particulate Air filter)

MP-01: Uranium Burnback
Applicant's Safety Approach

- Applicant has identified final HEPA filters as PSSCs for other safety strategies
- Selected a preventative strategy to remove fine particles and allow HEPA filters to perform their safety functions
- Safety controls:
  - Original application: no controls
  - RCAR strategy (June 2004): 2 high strength metal prefilters identified as PSSCs; also additional protective features (APFs) included

MP-01: Uranium Burnback
Applicant's Safety Controls

- High strength stainless steel mesh prefilters (spark arrestors)
- Protected two-stage final HEPA filters with structural integrity of >10 inches of water
- Multi redundant ventilation fan systems
- Ventilation system design ensures adequate air flow dilution
- Ventilation system design ensures a pressure drop of <10 inches of water across the HEPA filter elements
- Fire areas protected by two-hour minimum rated fire barriers
- Administrative control for inspection/maintenance of HEPAs/filters

MP-01: Uranium Burnback
Prefilters (Spark Arrestors)

- Prefilter 1: stainless steel wire mesh in stainless steel frame
- Prefilter 2: stainless steel and fiberglass mesh
- Safety Function: protect final HEPAs by removing particles from the airstream
- Design Basis: > 90% removal for particles > 1 micron size

Note: applicant states particle size is circa 100 micron upon receipt and circa 2 micron after ball milling

MP-01: Uranium Burnback
Applicant's APFs

- UO_2 delivered to the facility site and stored in sealed, 30 gallon drums.
- UO_2 is double-bagged within the drums, under nitrogen atmosphere.
- UO_2 is maintained in a nitrogen atmosphere throughout the process.
- Fire detection and suppression systems provided for gloveboxes (CO_2 injection) and process rooms (clean agent).
- Use noncombustible or nonflammable materials for process equipment construction and finishing.
- Control of combustible materials

APFs = Additional Protective Features – not PSSCs

MP-01: Uranium Burnback
Staff Evaluation/Conclusions

- Staff postulated a glovebox spill or fire could disperse fine UO_2 into ventilation system (C4)
- Staff analysis:
  - Ball milled material
  - Amount deposited on HEPAs 10-25% of that needed to cause temperature damage
- Staff concluded adequate safety strategy
  - HEPAs would survive burnback
  - HEPAs would continue to perform safety function

CS-05b: Chemical Limits - TEELs Introduction

- Limits required for assessing consequences from NRC-regulated chemical events
  - 70.61: protect from high and intermediate consequence events involving acute chemical exposures
  - 70.65(b)(7): "description ... quantitative standards ... from acute chemical exposure ..."

CS-05b: Chemical Limits: TEELs

Safety Issue

- Chemical limits used to determine PSSCs and design bases
- SRP – NUREG-1718 examples:
  - AEGLs – Acute Exposure Guideline Levels
  - ERPGs – Emergency Response Planning Guidelines
  - Other cited values, such as OSHA and NIOSH [PELs, STs, Cs etc.]
- Applicant may use an alternative
- Significant variations between different limits
- Variations affect presence or absence of PSSCs

CS-05b: Chemical Limits: TEELs

Applicant's Safety Approach

Chemical Limits:

- Initial Application: none
- Revised Application:
  - Use AEGLs or ERPGs, where available
  - Use TEELs otherwise
  - Several significant variations in values
- Revised Application (June 2004):
  Table 8-5 values – TEELs and ERPGs

TEELs = Temporary Emergency Exposure Limits

CS-05b: Chemical Limits: TEELs

Applicant's Chemical Limits

Consequence Category	Worker (Facility and Site)	IOC/Public
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Site Worker = 100 m receptor

IOC = Individual Outside Controlled Area Boundary = 160 m receptor

CS-05b: Chemical Limits: TEELs

Applicant's Commitments

Consequence Category	Worker (Facility and Site)	IOC/Public
High	< Level 2	< Level 1
Intermediate	< Level 2	< Level 1
Low	< Level 2	< Level 1

CS-05b: Chemical Limits: TEELs

FSER Evaluation/Conclusion

- Multiple limits available
- Level 3 values trend towards high range of all the limits
- Level 2 values:
  - Much lower
  - All below IDLHs
  - More consistency with other limits
- Applicant commitment to < Level 2 (worker) and < Level 1 (IOC/public) addresses concern
- Level 1 approximates habitability limits
- FSER finds Tables 8.5-8.7 approach acceptable for construction

CS-10: Control Room Habitability - Introduction

- The proposed facility has multiple control rooms and control areas
- The applicant has identified two Emergency Control Rooms (ECRs)
- ECRs have two main functions:
  - maintain a habitable environment for operators
  - provide cooling to emergency electrical rooms

CS-10: Control Room Habitability

ECR Ventilation Systems (HVAC)

- System consists of two, 100% capacity air filter trains (1 for each ECR)
- Each ECR train has one intake
- Each ECR train consists of a filtration unit and booster fan for each intake
- Each filter consists of:
  - hazardous gas removal cartridge and/or organic vapor cartridge
  - HEPA filter cartridges

CS-10: Control Room Habitability

Safety Issue

- Several chemicals onsite could affect habitability
  - Liquids: HNO_3, N_2H_4, solvent
  - Liquid/gas: N_2O_4, chlorine
- Releases of these chemicals could prevent ECR operators from performing safety functions

CS-10: Control Room Habitability

Applicant's Safety Approach

- Applicant has identified chemical release events as affecting the ability of ECR operators to perform safety functions
- Initial application: PSSC but no DB
- FSER: permit condition requires habitable DB

CS-10: Control Room Habitability

Applicant's Safety Controls

- ECR ventilation (HVAC) identified as PSSC
- Safety function is to maintain habitability for operators to perform safety functions
- Design bases use (FSER Table 8-12):
  - IDLHs from R.G. 1.78/OSHA
  - Level 2 values (Table 8.5) if no IDLH
  - Level 3 values if < IDLH

CS-10: Control Room Habitability

Other Aspects of Approach (I)

- Each ECR intake is continuously monitored for hazardous chemicals.
- Upon detection of a hazardous chemical above allowable limits, the intake is automatically isolated and switched to the recirculation mode using a filtration unit with HEPA filtration and hazardous gas removal elements.
- An alarm sounds if hazardous chemical levels are detected at both intakes.
- The alarm alerts operators to don emergency self-contained breathing apparatuses (SCBAs).

CS-10: Control Room Habitability

Other Aspects of Approach (II)

- Applicant stated that monitoring would be performed for those chemicals whose unmitigated release could result in control room concentrations exceeding the limits (RCAR Table 8-5a)
  - The emergency actions would be initiated when the chemical concentrations are at or below the TEEL-3 limit
  - Specific setpoints would be determined during the final design

CS-10: Control Room Habitability

Asphyxiation

- Design Approach (LA):
  - During detailed design, individual rooms and areas will be addressed on a case by case basis to establish if air monitors with alarms are required.
  - To avoid asphyxiating atmospheres, high ventilation rates are specified to preclude the creation of an asphyxiating atmosphere.
  - *Publication P-14 of the Compressed Gas Association (CGA), "Accident Prevention in Oxygen Rich and Oxygen-Deficient Atmospheres"*

CS-10: Control Room Habitability

Staff Evaluation

- Applicant has:
  - Identified a safety function for ECR operators
  - Identified a safety function to maintain habitability in ECRs for operators
  - Identified a PSSC of ECR HVAC
- Staff found:
  - Table 8-5a values correspond to short exposures (2 minutes per R.G. 1.78)
  - These are inconsistent with habitable conditions

CS-10: Control Room Habitability

Staff Conclusions

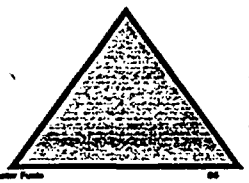
- Habitable conditions approximated by Level 1 values in Table 8-5.
- Proposed Permit Condition:
  - additional safety function of ECR HVAC shall maintain chemical concentrations below Level 1 values for duration of the event
- Staff concludes approach and permit condition provide for adequate assurances of safety

CS-09, AP-02,08,09: Flammability - Introduction

- The proposed facility uses flammable gases and combustible liquids
- Flammability control approach needed:
  - CS-09: Solvent Temperature DB
  - AP-02: Electrolyzer Flammable Gas Generation
  - AP-08: Offgas Unit Flammable Gases
  - AP-09: Offgas Solvent Flammability

CS-09, AP-02,08,09: Flammability Safety Issue

- Flammable and combustible materials can initiate fires and explosions
- Fires and explosions can breach confinement and release radiochemical materials



CS-09, AP-02,08,09: Flammability Applicant's Safety Approach

- Proposed a preventative strategy
- Adopted NFPA 69 as DB
- Identified 6 Areas of Applicability (AOAs) and associated PSSCs:

1: SX, Recovery, Wastes
2: Oxalic Precip/Mother Liquor
3: Higher T in Acid Recovery
4: Low T in Acid Recovery
5: Hydrogen from radiolysis
6: Hydrogen from electrolysis

(Proposed PSSCs and DB (25% of LFL) around Sintering Furnace and LFL methodology already accepted)

CS-09, AP-02,08,09: Flammability

Staff Review

- Reviewed NFPA 69
- Reviewed other guidance
- Reviewed electrolysis

CS-09, AP-02,08,09: Flammability

NFPA 69 (I)

- Standard on Explosion Prevention Systems
- Provides guidance on oxidant/combustible concentration reduction, suppression, containment, and spark extinguishing
- Combustible concentration
  - At or below 25% of LFL
  - Exception: at or below 60% of LFL provided automatic instrumentation with interlocks

CS-09, AP-02,08,09: Flammability

NFPA 69 (II)

Basic Design Considerations (Section 3-2):

- Required concentration reduction
- Variations in process, temperature, pressure, and materials
- Operating controls
- Maintenance, inspection, and testing

CS-09, AP-02,08,09: Flammability

NRC SRP Guidance (I)

MOX Standard Review Plan – NUREG-1718

- Chapter 7 – Fire
  - use and interpretation of codes and standards
  - some specific recommendations
- Chapter 8 – Chemical Safety
  - specific interactions (e.g., radiolysis, degradation)
  - analyze potential accidents

CS-09, AP-02,08,09: Flammability

NRC SRP Guidance (II)

Recommendations on Hydrogen Supply

- Designed to withstand seismic events or no internal leaks or shutoff so that 2% not exceeded
- Bulk storage outside
- Master shutoff valves on hydrogen tanks
- Inerting mentioned - around reducing furnace doors and purging during automatic shutdown

CS-09, AP-02,08,09: Flammability

NRC SRP Guidance (III)

Other Recommendations Involving Hydrogen

- Inert gas use: oxygen content not to exceed 25% of the level needed for combustion
- Inert gas purge and vent on SNM bearing solution tanks
- If inerting not used, other recommendations, such as ventilation so that hydrogen concentrations maintained below 25% of LFL in tanks, pipes, etc. under all expected process conditions

CS-09, AP-02,08,09: Flammability

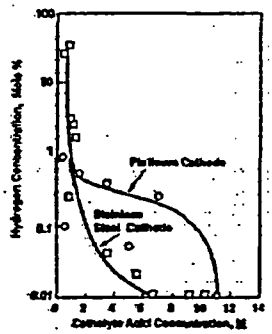
Related NRC Guidance & Activities

- Report on Hanford Tank Wastes:
  - NFPA 69 applied inside vessels
  - Hydrogen not to exceed 25% of LFL
  - Based on interpretation of NFPA 69, as applied to the situation

CS-09, AP-02,08,09: Flammability

Electrolytic Hydrogen

- Shows acid Concentration can Control hydrogen



CS-09, AP-02,08,09: Flammability

FSER Conclusions

- Staff accepts preventative strategy
- Staff accepts general use of NFPA 69 as DB
- Staff will review implementation to check that any proposed interlocks can perform safety functions
  - Applicant has different strategies to pursue
  - Clear calculational and experiential basis needed, with setpoint analysis
  - Deferred until ISA in LA
- Acceptable for construction

Summary
70.61: Performance Requirements

- Previously identified open items from:
  - DSER
  - Revised DSER

  have been satisfactorily addressed by additional controls and safety strategies
- Staff concludes, pursuant to 70.23(b), that DBs of PSSCs proposed by the applicant will provide reasonable assurance of protection against NPH and accidents

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Summary
70.64: Baseline Design Criteria (BDC)

- BDC 3 for fires/explosions and 5 for chemical safety
- Applicant:
  - Proposed many strategies, PSSCs, and DBs
  - Used many specific codes and standards
  - Adopted RAGAGEP in many areas
  - Provided information to resolve open items
  - Stated BDCs are incorporated (RCAR 5.5.5.4)
- Staff concludes applicant has met BDC

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Overall Summary

- Unique licensing
  - First significant application of revised Part 70
  - Plutonium facility
  - Two-part licensing
- Many NRC/applicant interactions and working together have resulted in:
  - Improved safety controls
  - Significant improvements in applicant's safety strategies
  - Greater assurances of safety
- The licensing process has added value

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FSER Open Item Resolution Since November 2003: NCS Review Area

Christopher S. Tripp
Criticality Safety Reviewer
NMSS/FCSS/TSG

NCS-04: MOX Validation

- Prior to last ACRS meeting:
- Previously closed for areas of applicability:
  - AOA(1): Pu-nitrate solutions
  - AOA(2): MOX pellets, rods, assemblies
  - AOA(5): Miscellaneous Pu-compounds
- Still open:
  - AOA(3): PuO_2 powders
  - AOA(4): MOX powders

NCS-04: MOX Validation

- Current Status: Closed
  - AOA(3): Approved
  - AOA(4): Approved with permit condition:
    - Additional 1% margin in k_{eff}
    - Reduced parametric range
      - Narrowed range in H/X
      - Narrowed range in EALF
      - Limited to <60cm DU reflector
  - Permit condition required due to reduced number of benchmarks for MOX powders

K_{eff} Margin

- Benchmarks for AOA(4) non-normal
- Committed to follow NUREG/CR-6698
- Nonparametric Method:
  - Uses lowest calculated k_{eff} & nonparametric margin (NPM)
  - NPM depends only on total number of benchmarks
- Method applied to AOA(3) & AOA(4)

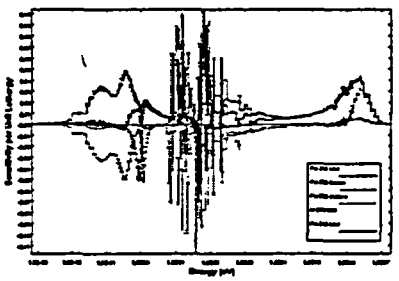
Application of NPM

- AOA(3):
  - 25 PuO_2 & 24 Pu-metal benchmarks
  - PuO_2 benchmarks found acceptable based on:
    - Similar materials, geometry, energy spectra
  - Pu-metal benchmarks found acceptable based on:
    - Differ from oxide only by density & chemical form
    - Staff calculations showed k_{eff} insensitive to density
    - Effect of oxygen on k_{eff} negligible
    - Confirmed by ORNL S/U code (TSUNAMI)
  - 49 applicable benchmarks → 0% NPM

Application of NPM

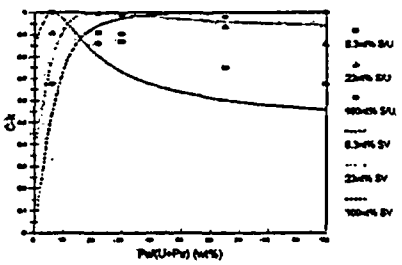
- AOA(4):
  - 42 MOX & 17 PuO_2 benchmarks
  - 38 MOX benchmarks found acceptable
  - 4 MOX benchmarks too high H/X
  - 17 PuO_2 benchmarks not shown applicable
    - Low correlation to 6-22wt% Pu-content MOX
    - Comparison of fission spectra not sufficient
    - Increasing importance of ^{238}U capture at low Pu/(DU+Pu)
  - 38 applicable benchmarks → 1% NPM

Applicability of low-Pu



Applicability of low-Pu

Ck vs. Pu-content: MOX-water spheres



Low-Moderated MOX

- Recognized shortage of low-H/X MOX benchmarks
- OECD/NEA workshop held April 2004 in Paris
  - Share experience with MOX licensing issues
  - Assess need for additional benchmarks
  - Decide among 6 competing proposals
    - Most for reactor-grade (RG)-MOX
    - Most using close-packed fuel rods

Low-Moderated MOX

- NRC position:
  - Weapons-grade (WG)-MOX benchmarks useful to support future flexibility (given restrictions to AOA)
  - Not needed to license MFFF (given additional margin acceptable)
  - MOX powder benchmarks with WG isotopics preferable

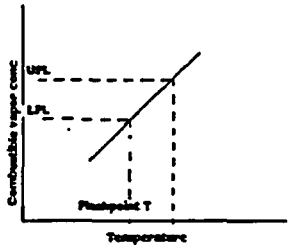
Follow-on Actions

- TSUNAMI results part of basis for FSER
- Not available to DCS; not approved code (QAP)
- Part of supporting analysis for design basis not incorporated into DCS documentation
  - 13 follow-on areas for additional demonstration identified
  - FSER states basis will be reviewed by staff in license application
  - DCS has informed us they'll provide substantiation in separate submittal

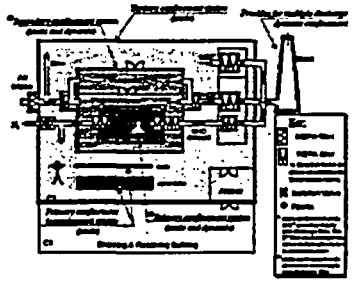
Additional Slides

- Safety Evaluation Report on the Construction Authorization Request for the Mixed Oxide Fuel Fabrication Facility

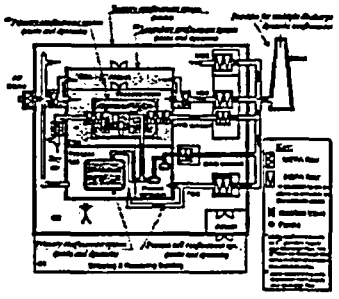
Flammable Vapor Concentration vs. Temperature Curve



MOX Fuel Fabrication Process (MP) Ventilation Confinement

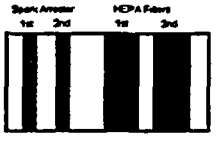


MOX Aqueous Polishing (AP) Ventilation Confinement



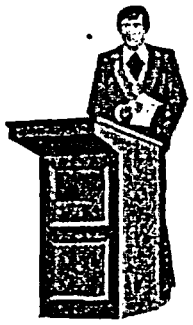
Final HEPA Filtration Units

- 1st stage spark arrester is stainless steel wire mesh
- 2nd stage spark arrestor is stainless steel mesh with interwoven fiberglass to remove particles > 1 micron diameter
- HEPA are glass media with metallic frames, silicone gaskets
- DB temperature: 450 F DB press. = 10 in WG



Safety Concerns and Differing Viewpoints and Opinions on MOX

Alex Murray
Lead Chemical Safety Reviewer
NMSS/FCSS/SPB/MOFLS



Overview

Provide feedback on:

- **Safety Review Process**
- **Previously Open Items**
- **DPVs/DPOs**

Note:

I am impartial – neither for nor against the proposed facility.

I am concerned some safety issues remain and need to be addressed now and not at the License Application stage.

Safety Review Process

Two Step Licensing:

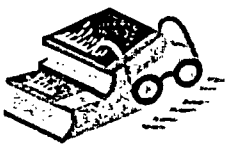
- **Step 1:**
  - Construction Permit
  - Present
- **Step 2:**
  - Licensing – possession and use
  - Future (next year)
- Concern is the balance between the two and how much can be deferred and revisited later in the licensing stage, particularly for commitments

Safety Regulations

- Part 70.23(b): NRC approved when it has determined the DBs of the PSSCs, and QA plan, provide reasonable assurance of protection
- Part 70.61: Compliance with Performance requirements
- 70.64(a): Address the Baseline Design Criteria

Commitments are not mentioned

Safety Guidance



SRP:

- Chapter 8 for chemical safety
- Arranged for two-part licensing review
- Commitments may be acceptable

On MOX, accepted PSSCs and DBs that:

- In general, have less information than SRP mentions
- Are not RAGAGEP
- Rely on future efforts and experiments to define current PSSCs and DBs

RAGAGEP = Reasonable And Generally Accepted Good Engineering Practice

Diverse Viewpoints

Part of NRC strategic plan – safety and effectiveness goals

- Staff/management discussions
- Nonconcurrences
- Differing Professional Views and Opinions (DPVs and DPOs)

Some Observations

- A voting - not a consensus - process
- Nonconcurrences written – but not accessible by the public
- DPV/DPO only practical route to upper management and public
- Prevailing staff/management and MOX management often involved in DPV/DPO process – objectivity and independence unclear
- Unclear if staff have adequately followed QA and documentation needs
- A number of workshops are being conducted to address some of these issues

Public Comment

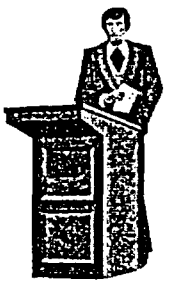
"The NRC needs to act as a regulator and conduct thorough safety reviews [of the MOX facility]"

(public comment during August 2002 public meeting on MOX, North Augusta, South Carolina)

Comments on Previous Open Items

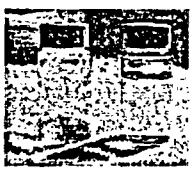
FSER Issues discussed earlier today and at November 2003 ACRS meeting

- CS-01: Red Oil
- CS-02: HAN/Hydrazine
- AP-03: Electrolyzer /Titanium Fire
- MP-01: Uranium Burnback
- CS-05b: Chemical Limits/TEELs
- CS-10: Control Room Habitability
- CS-09, AP-02, AP-08, and AP-09: Flammability

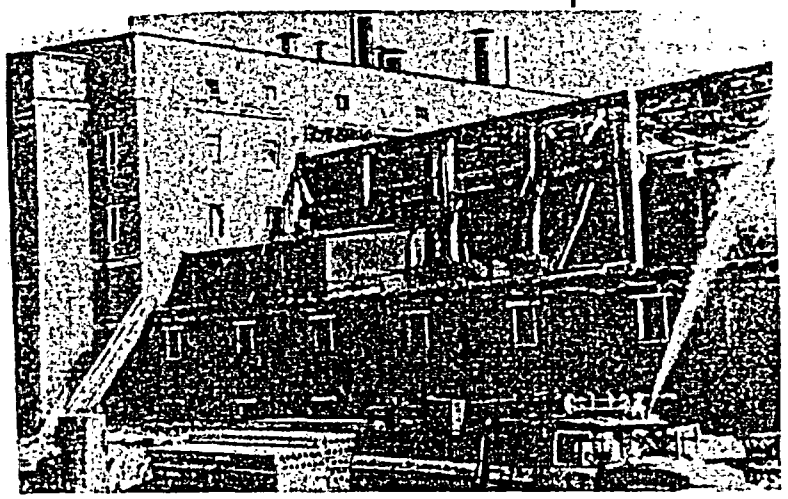


CS-01: Red Oil

- Nitrated TBP/organic compound mixtures
- Potential for significant damage and release of materials
- Open Systems:
  - Limited information provided by applicant
  - Acceptable because clearly based on test data
- Closed Systems:
  - Limited information provided by applicant
  - Clearly contradicts DOE/DNFSB RAGAGEP
  - In range identified as "unsafe"

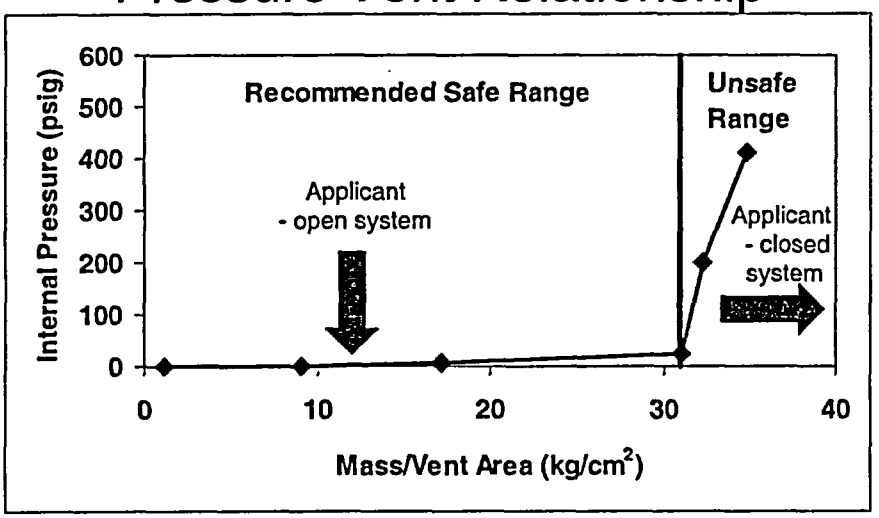


Why I am concerned - Tomsk Red Oil Explosion



CS-01: Red Oil

Pressure Vent Relationship



My Conclusions:

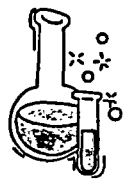
- Approach for closed systems does not provide adequate assurances of safety:
  - Corresponds to 1 control parameter (T)
  - Common mode failure – heat transfer and vent
  - Inadequate margin
  - Uncertainties not adequately considered
  - High aspect ratio design will likely result in higher pressures and temperatures, and phase separation
  - No assurance quench system and 125 C limit will prevent red oil reactions
- No assurance approach can meet Part 70 requirements for a Construction Permit

My Recommendation

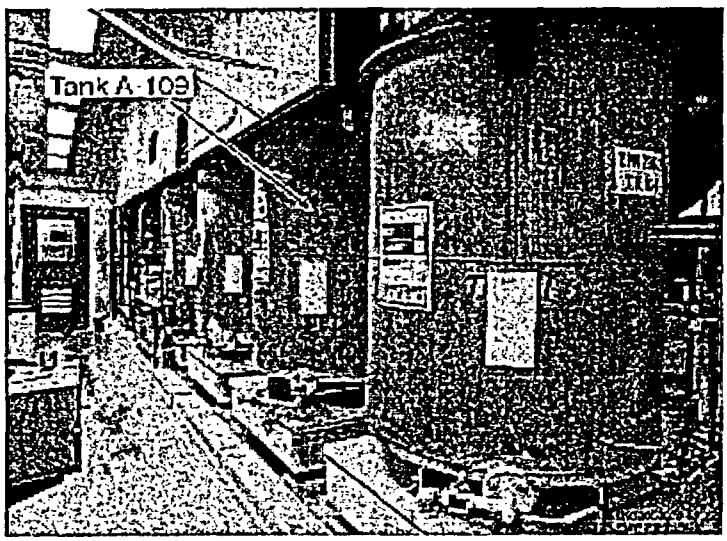
- Impose DOE/DNFSB RAGAGEP as permit condition
- Give applicant the opportunity to provide assurances about their strategy in the license application

CS-02: HAN/Hydrazine

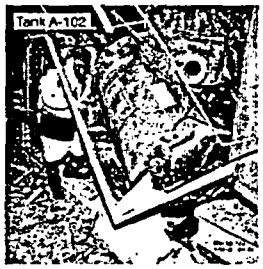
- Potential for rapid pressurization
- Two cases:
  - Case 1 – without NO_X
  - Case 2 – with NO_X addition
- Case 1 modeled as a system of PDEs to identify regions of stability and margin.



PRF Room Prior to Accident



Why I am concerned - PRF Accident Scene



My Conclusions

- Case 1: no NO_X
  - Have only checked the mathematics
  - NRC model/software guidance for making a safety decision not followed
  - Contradictory design bases with hydrazoic acid
- Case 2: with NO_X
  - Applicant removed flow control
  - Cited standards accommodate flow design not flow control
- No assurance of meeting Part 70 criteria for construction permit

Recommendation

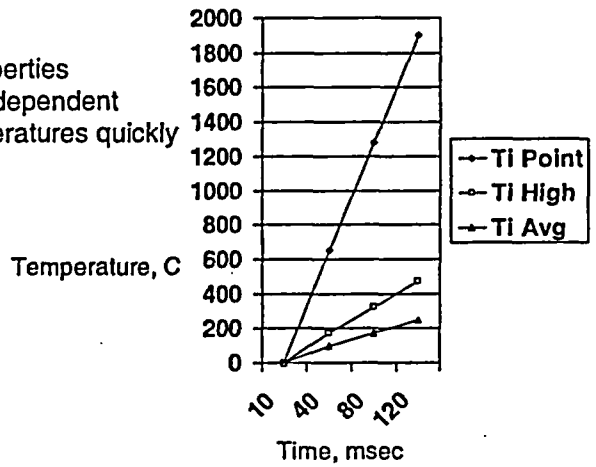
- Case 1: no NO_X
  - Have applicant commit to schedule to resolve DB conflict early after CAR/permit
- Case 2: with NO_X
  - Propose applicant's original flow control as permit condition
  - Give applicant the opportunity to provide assurances about their strategy in the license application

AP-03: Electrolyzer/ Titanium Issues

- Potential for titanium interactions and fires
- Applicant's strategy using RAGAGEPs
- Active and passive engineered controls (AECs and PECs)
- Active control terminates power, which removes the initiator for the event
- Find the approach of AECs and PECs meets Part 70 requirements

AP-03: Electrolyzer/Titanium Issues – Rapid Heating Possible

Assumed constant properties
Geometry and system dependent
Potential for high temperatures quickly



MP-01: UO_2 Burnback

- UO_2 Burnback reactions can damage HEPA filters directly or indirectly (igniting fibers/dust on the filters)
- Strong function of particle size
- Use of applicant UO_2 values produces higher loadings than staff calculations
  - Exceed threshold for one HEPA unit
  - 50-80% of threshold if distributed over C4 HEPAs
  - Contribution from other material on HEPAs not included

Burnback

- One or more features need to be identified as PSSCs and credited for safety
- Recommendation:
  - Propose permit condition that elevates intermediate HEPA filters to PSSCs for this event

CS-05b: Chemical Limits

Four Issues:

- Chemical releases – discussed as DPV/DPO later
- Modeling:
  - Dispersion Modeling – discussed as DPV/DPO
  - Phenomenological Modeling – addressed in FSER
- Chemical Limits – this discussion

Chemical Limit Concerns

- Findings from RDSER not addressed:
  - TEELs not independent, peer/public reviewed
  - TEELs not endorsed by a regulator
  - Certain TEEL values have increased substantially during review of the CAR
- Procedural Issues:
  - Policy decision – qualified staff not involved
  - Prior staff evaluations of limits not considered
  - Public not involved
  - Other regulators not consulted

Chemical Limit Concerns (cont.)

- Safety Issues not addressed:
  - Why are significantly higher values acceptable?
  - Why are values that frequently change acceptable?
  - What is appropriate for determining PSSCs and DBs?
- Recommendation: NRC needs a task force of qualified staff to address chemical limits

CS-10: Habitability

- Safety function of ECR HVAC is to maintain habitability
- Applicant's limits do not correspond to habitability
- Proposed permit condition applies habitability limits

Flammability Issues

- Applicant proposed NFPA 69 as design basis
- Applicant identified PSSCs for various areas
- Some PSSCs may not function as interlocks for NFPA 69 exception
- Staff has accepted NFPA 69 and expressed need for clear calculational basis for any exception with interlocks, for the license application

DPVs/DPOs

- 5 DPVs filed
- MD 10.159 DPV/DPO process changed in May 2004
- 2 DPVs went through full process
- 2 Management appointed panels agreed essentially 100% with the DPVs
- Actions and response did not address safety issues
- Both pursued as DPOs

DPV/DPO Process Changed

- Process has DPO and DPO Appeal, no DPV
- Authority delegated to NMSS for DPOs on MOX
- NMSS has signature authority for MOX
- Consolidation of MOX issues mentioned

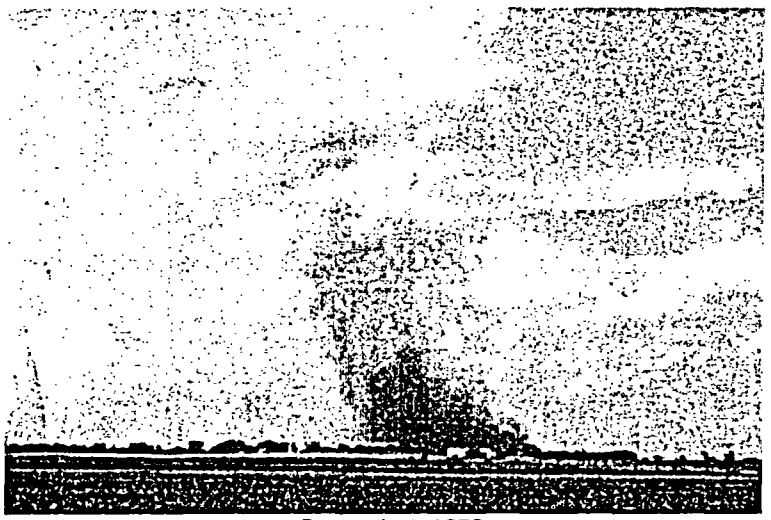
DPV/DPO on Chemical Consequences

- DPV expressed concerns about chemical releases regulated by NRC
- Applicant has stated:
  - Not unlikely event
  - Radiation dose received (10s of mrem to 5-10 rem)
  - Not regulated because below 70.61
- Event has the potential for multiple fatalities, perhaps all operators outside the ECRs

NRC Assessment

- Management/staff
  - 1,500 mg/m^3 at 100 meters for N_2O_4 (in EIS)
  - "Immediately lethal"
- My assessment:
  - Estimated concentrations could be higher
  - Facility design exacerbates hazard
  - Safe havens not PSSCs
  - Unlikely operators could reach safe havens or exits

N_2O_4 Release Example



DPV Panel Findings

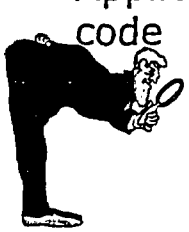
- DPV Panel agreed essentially 100%
  - Recommended the issue be re-opened or a new open issue established
  - Also recommended more guidance and review of safety evaluation process
- NRC Office/Division not in alignment with Panel report and decided:
  - Enough information on the docket, no need for the open item
  - Some guidance provided
- Review of safety evaluation process resulted in a chilling effect

Draft DPO Report

- No further action needed as safety issue is addressed
- Applicant has made blanket commitments without exception to:
  - Codes and standards with habitability requirements
  - 70.64 BDC for chemical safety – habitability implied as part of BDC
- Therefore, applicant is required to maintain habitability in all structures at the proposed facility

Summary of DPV/DPO on Chemical Modeling (I)

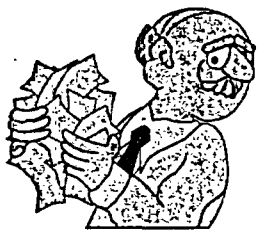
- Multiple codes available for dispersion and consequence estimation
- Applicant initially selected ARCON96, MACCS2, and ALOHA codes
- Applicant subsequently used only ARCON96 code



ARCON96 (coincidentally) produces lowest consequence results

Summary of DPV/DPO on Chemical Modeling (II)

- Applicant provided input meteorology info
- No verification and validation info provided
- No QA/qualification info provided



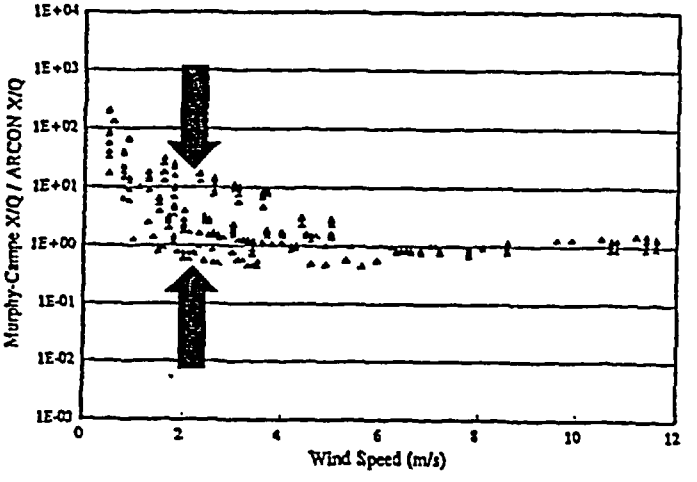
Fundamentally, no data
On docket to support
Site specific safety code
Use at SRS MOX site

Summary of DPV/DPO on Chemical Modeling (III)

Authored DPV/DPO because:

- Matter closed – no reconsideration by local mgmt
- Safety significant:
  - potentially underestimate consequences by 1-2 orders of magnitude
  - Safety controls may be unidentified
- Submitted December 2002

Model/Data Comparisons (I)



- Applicant Using SRS Wind speed Of 2.2 m/sec
- Which value to use?

Figure 27 Murphy-Campe / ARCON concentration ratios by wind speed
(based upon data from 7 reactor sites in NUREG/CR-6331 on ARCON96)

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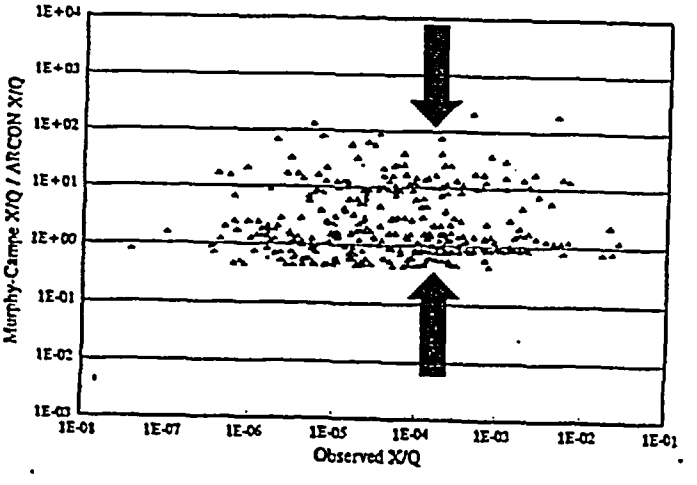
Model/Data Comparisons (II)



- Applicant Using Circa 3E-4
- Which value to use?

Figure 28 Murphy-Campe / ARCON concentration ratios by observed concentration
(based upon data from 7 reactor sites in NUREG/CR-6331 on ARCON96)

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Subcommitte

DPV Panel Findings

Essentially agreed with DPV:

- Panel noted generic use of ARCON96 OK
  - **but** site specific application for MOX not verified/validated against site test data
- NRC guidance on software not followed
- Staff guidance on code selection and user needs

Office/Division Responses

On DPV/DPO Appeal, not in alignment with DPV Panel Report:

- Docketed information available
- MDs and NUREG/BR-0167 (Software QA Guidance) not useful
- Sufficient staff guidance available
- RES user-need memo for development/application of scientific codes

DPO Appeal

Three Main Points:

- Information cited is not V&V
- No adequate QA on applicant's code
- Safety issues remain

Received DPO Report Monday (12/13), from a quick review:

- DPO appeal denied
- Implies V&V for site-specific application not needed

DPV on Waste Management Concerns

- Safety issues refer to premature closure of Open Items AP-05 and AP-06. Applicant should:
  - Confirm MFFF wastes are treated to meet SRS WACs and will be accepted
  - Identify PSSCs and DBs for the waste unit, such as an inventory limit DB and shutdown requirement
- Clearly within NRC regulatory authority

Waste DPV

NRC:

- Delayed the DPV for about a year
- Denied the DPV – waste is under DOE jurisdiction

Subsequently:

- NTEU filed a grievance on the process
- I requested the ACRS/ACNW review the DPV and the safety issues

DPVs on Chemical Limits and Flammability

NRC:

- Delayed the DPV for about 10 months
- Asked for resubmission

Subsequently:

- NTEU filed a grievance on the process

Summary

- Process and specific safety concerns
- Potential for more DPOs
- We – NRC, applicant, and DOE - need to do a good job and address these issues