

1 DR. RYAN: Thanks.

2 CHAIRMAN POWERS: Let me see, I was going
3 to ask you where your azides formation step is.

4 MR. KLASKY: Okay. Mark, go back to the
5 second figure.

6 In the plutonium stripping unit the --
7 when nitrous acid is consumed by hydrazine and
8 produces and hydrozyllic acid. And if impurities
9 happen to be present, in the presence of impurities,
10 different metal azides may be formed.

11 Again, it should be in the aqueous stream.
12 They're going to be moved into an oxidation column and
13 those azides in an acidic medium, again you'll
14 basically retransform or you'll never -- you shouldn't
15 really produce metal acid. You should have hydrazylic
16 acid, and that hydrazylic acid also undergoes a rapid
17 reaction with nitrous acid and should be destroyed in
18 the oxidation column.

19 Again, we sample coming out of the
20 oxidation column to make sure it doesn't propagate.

21 In addition, coming out of the plutonium
22 stripping unit the organic stream is moved into in the
23 end a solvent regeneration process. This solvent
24 regeneration process uses sodium hydroxide, sodium
25 carbonate as reagents. And if there is, in fact,

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1 hydrazyllic acid in the organic stream, sodium azide
2 will be formed. That's precisely the unit function
3 that I just described for the waste treatment unit
4 will add sodium nitrite and then we'll sidify and
5 we'll destroy the hydrazoic acid, so we'll retransform
6 to hydrazoic acid.

7 So there's a couple of areas where we know
8 we have hydrazoic acid and we have to be careful, of
9 course, with respect to the hydrazoic acid. And we've
10 described the safety controls to control hydrazoic
11 acid and its closed.

12 CHAIRMAN POWERS: What species -- what is
13 the least soluble azide in your system here?

14 MR. KLASKY: The least soluble? Silver
15 azide has a low solubility, I believe. And in our
16 normal processing that we've described, we of course
17 limit -- the solubility -- I mean, there shouldn't be
18 any silver in the plutonium stripping unit. It is a
19 very, very low distribution coefficient, it's not
20 extractable. So, you know, entrainment of course,
21 however, can occur. That's why we have a scrub unit as
22 well.

23 Within the plutonium stripping unit, of
24 course, if it is trace quantities present, we could
25 form silver azide. But, again, it would be in essence

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1 destroyed or retransformed to hydrazoic acid and
2 destroyed in the oxidation unit. And I think we
3 describe the specific controls or principle SSCs so as
4 to preclude moving that azide into heated equipment.
5 I mean, that's our real focus is to ensure that we
6 don't introduce azides into -- and also to -- excuse,
7 insure that we don't dry out equipment that may
8 contain azides.

9 So, it's sort of a safety philosophy that
10 recognizes that such azides may be present and is
11 ready to deal with their presence as opposed to saying
12 that we won't form any.

13 MR. VIAL: Yes. There were some -- that
14 initiated the formation of azide react really fast or
15 slow with nitrous. So --

16 CHAIRMAN POWERS: Yes, that's what he was
17 saying.

18 MR. KLASKY: Yes. I guess that's one
19 additional remark that I'd make, that we spoke re-
20 oxidation of plutonium. It occurs both in the aqueous
21 stream and the organic stream. And the nice thing is,
22 you know, you do have hydrazine, it is attacked by
23 nitrous acid, it forms hydrazolic acid. Hydrazolic
24 acid is a very large affinity to the organic stream.
25 And so in essence hydrazolic acid is your mechanism is

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1 scavenge nitrous acid in the organic stream as well.

2 CHAIRMAN POWERS: Clever.

3 Any other questions for the speakers?

4 Thank you, gentlemen.

5 Bill, you're on again.

6 MR. TROSKOSKI: All right.

7 CHAIRMAN POWERS: And those of you that
8 think this chemistry discussion is going on too long,
9 just look upon this as the HAN dynasty

10 MR. TROSKOSKI: Ladies and gentlemen, this
11 next discussion will cover the challenges associated
12 with the spontaneous autocatalytic chemical reaction
13 that can occur in the HAN-nitric acid solution
14 typically found in your plutonium uranium separation
15 processes.

16 Again, this type of runaway reaction is
17 generically similar to those encountered in the
18 chemical process industry. And the approaches used by
19 the chemical process industry, mainly the Process
20 Hazard Analysis, are valid for the HAN reactions.

21 The HAN autocatalytical oxidation reaction
22 is strongly exothermic and has overpressurized process
23 vessels through the production of large amounts of
24 gaseous products, mostly nitron oxides. The reaction
25 rate is multiperimetered ended, which include the

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1 reagents and products, temperature, normality, biontic
2 strength and impurities which can act as catalysts.

3 The reaction can occur in the organic,
4 aqueous and gaseous phases, and in short it is a
5 complex phenomena that has occurred more often than
6 the red oil reactions we previously discussed.

7 The staff is reviewing the applicant's
8 initial approach that has been put forth in the
9 Construction Authorization Request, and that we've
10 discussed in several meetings with them. However, the
11 staff notes that at this time the applicant has not
12 yet finalized its safety strategy.

13 The staff has gathered the published
14 operational event history related to the HAN reactions
15 and the DOE, and the associated DOE technical reports.

16 HAN also has non-nuclear applications and
17 the staff is aware that there have been runaway
18 reactions with this process in the chemical process
19 industry.

20 We believe that actual field data are
21 invaluable in reviewing the technical viability of any
22 safety strategy approach.

23 I have already alluded to the complexities
24 of the HAN nitric acid system, that is multiperimeter
25 and multiphase. In terms of the classic fuel, oxygen,

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1 heat triangle, HAN concentration is certainly a key
2 perimeter and safety limits need to be defined for it.

3 For the oxidation leg of the triangle, in
4 simplified terms, HAN reacts with nitric acid to
5 produce nitrous acid, which is related to the
6 subsequent formation of another chemical
7 intermediation N_2O_4 . It's the rate of N_2O_4 formation
8 that is also a function of temperature and normality.
9 Controlling the rate and formation or the availability
10 of NO_2 is the key to really preventing an
11 autocatalytic reaction from occurring.

12 Finally, the temperature at which an HAN
13 reaction occurs is another complex variable, dependent
14 on concentrations and ratios of nitric acid in HAN, as
15 well as the presence and concentration of potential
16 catalysts such as iron.

17 Did I miss one? Yes.

18 CHAIRMAN POWERS: But you've changed
19 what's presented to us from what we have here. Go
20 back.

21 MR. TROSKOSKI: That's First Principles.
22 Do you have that?

23 CHAIRMAN POWERS: No. We have the
24 principals of schools here instead of principles.

25 MR. TROSKOSKI: I confess. I'm going to

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1 have to stand up and confess. That was my mistake.
2 My studious project manager caught it and he tried to
3 catch it, but apparently --

4 MR. ROSEN: He caught it in most places.

5 MR. TROSKOSKI: In most places.

6 CHAIRMAN POWERS: It was a bad strategy on
7 your part. See, we could have -- there was an entire
8 paragraph in our letter that we could have written on
9 the spelling and now we're going to have to search
10 through to find something else to fill that paragraph.

11 MR. TROSKOSKI: I assure you, it is not
12 deliberate.

13 MR. SIEBER: You just want to be our pal.

14 MR. TROSKOSKI: Okay. I'm the Applicant's
15 PSSCs now. I did spell PSSC correct.

16 The applicant has indicated that they are
17 considering a safety strategy involving use of
18 hydrazine to scavenge nitrous acid before N_2O_4 can be
19 produced in the quantities and concentrations
20 necessary to support the autocatalytic reaction.

21 Looking at the entire process, the
22 applicant has identified safety strategies for three
23 distinct process applications. First, for those that
24 have HAN and hydrazine nitrate without NOx. That
25 occurs in the 3000 pulse column of the purification

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1 cycle where HAN is introduced to reduce the plutonium.

2 The second is HAN with no hydrazine
3 nitrate. And this is the HAN feed system in the
4 aqueous polishing process. I believe the applicant is
5 now considering a possible change to this portion of
6 the process.

7 The third one has to do with HAN and
8 hydrazine nitrate but with the addition of your NOx
9 gas. This occurs in the oxidation column in recycling
10 tanks. The NOx is used to destroy the HAN, the
11 hydrazine nitrate and the hydrazoic acid to prevent
12 propagation to downstream process units and the front
13 end of the purification cycle via the aqueous phase.

14 The PSSCs for the first two strategies are
15 similar. Both use the Process Safety Control
16 subsystem to maintain the temperature of HAN solutions
17 within safety limits.

18 Both also use the Chemical Safety System
19 to control and maintain the concentrations of HAN,
20 nitric acid and metal impurities to within safety
21 limits.

22 The third strategy is different because
23 the NOx is being added destroy the HAN hydrazine
24 nitrate and hydrazoic acid. The Chemical Safety
25 System is used to limit the concentration of these

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1 reactants. The offgas treatment system provides an
2 exhaust path for the gaseous byproducts of the
3 reaction and as a means of heat transfer pressure
4 relief.

5 Finally, the Process Safety Control
6 Subsystem controls the flow rates of the oxidation
7 column limiting the quantity of reactants to maintain
8 the heat generation and pressure increase to within
9 vessel design specs.

10 CHAIRMAN POWERS: Bill, have you thought
11 about the possibility of accumulation of ammonium
12 nitrate in the offgas treatment system?

13 MR. TROSKOSKI: No, we have not until
14 today, but we will be looking into that.

15 CHAIRMAN POWERS: You might want to look
16 at it. It's something that we struggled with a lot in
17 connection with some of the Rocky Flat systems and up
18 at Hanford. I mean, we would occasionally find
19 ammonium nitrate there. Whence it came from, I can't
20 tell you. But we would find it there and whatnot.
21 And, you know, like I say, the origins of it and
22 things like that, you really never know. Because we
23 were looking after 20 years of operation.

24 MR. TROSKOSKI: Sure. Offline, could you
25 give us a contact or do you know of anybody offhand?

1 CHAIRMAN POWERS: I'd have to --

2 MR. TROSKOSKI: We'll do the work.

3 CHAIRMAN POWERS: You know, let me think
4 about it and I'll see if I can come up with --

5 MR. TROSKOSKI: If not, I know some other
6 people.

7 MR. ROSEN: The implications of that,
8 Dana, are is it's a little bit explosive now and then.

9 CHAIRMAN POWERS: Yes, it's a material of
10 concern.

11 Let me say that we agonized heroically
12 over it, as did the operators there. I would never--
13 myself that the matter began, but we worried about it.

14 MR. TROSKOSKI: Okay. Well, that's what
15 I was asking. You're not sure it's a problem, but --

16 CHAIRMAN POWERS: Not sure at all.

17 MR. TROSKOSKI: Okay. So there's not an
18 operational event history?

19 CHAIRMAN POWERS: None.

20 MR. TROSKOSKI: Okay.

21 CHAIRMAN POWERS: Except that we did
22 occasionally find ammonium nitrate.

23 MR. TROSKOSKI: We'll look --

24 DR. LEVENSON: Dana, I'm not -- I know
25 Rocky Flats, etcetera, they found it. Ever find it in

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1 any of the plants that did solvent extraction, I'm not
2 aware of that.

3 CHAIRMAN POWERS: Milt, you're taxing my
4 memory here. But it's something to at least give an
5 afternoon's worth of thought over, I think.

6 MR. TROSKOSKI: Okay. I appreciate that.
7 Going on to industry events.

8 Understanding the data provided by real
9 industry events is a vital check of the proposed
10 safety strategies. Most of the HAN related events
11 involve significant elements of what I would term
12 conduct of operations. When strong azides are added
13 to HAN heels in a tank that are thought to be empty,
14 solutions are concentrated over a long period of time,
15 or external heat sources provide initiation
16 temperature, you're going to end up with problems.

17 The applicant proposed PSSCs which would
18 envelop these types of events. In addition, the staff
19 still expects that the initiators for each of the
20 known events would be addressed in detail in an
21 adequate ISA Process Hazard Analysis.

22 This is just classic chemical industry
23 approach.

24 MR. KLASKY: Bill, could I interrupt one
25 second.

1 MR. TROSKOSKI: Yes, sir.

2 MR. KLASKY: Go back to the previous
3 slide.

4 MR. TROSKOSKI: Okay.

5 MR. KLASKY: Again, give further
6 justification for our approach, I think what you see
7 here is that there are numerous mechanisms by which
8 the hydroxylamine concentration, or I should say the
9 nitric acid concentration can increase due to
10 evaporation or heating, the Hanford event of 1989 is
11 the only event you'll see there with hydrazine
12 present. And, in fact, I guess we argue after one year
13 you have a situation where you can destroy hydrazine
14 over long periods of time due to producing nitrous
15 acid due to radiolysis.

16 So our intent again is to not allow for
17 the storage of material, either HAN or hydrogen.

18 DR. FORD: Well, I seem to remember the
19 last presentation meeting that we had on this. There
20 was a presentation from someone who was talking about
21 process control, use of digital controlled equipment.
22 The reason I'm bringing it up, is at least two of
23 those items are because of human factors.

24 MR. KLASKY: At last from our perspective-

25 -

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1 DR. FORD: Is that still a factor or not?

2 MR. KLASKY: What we're attempting to do
3 here is to basically eliminate that from -- as a
4 possible initiator in that we're going to utilize
5 hydrazine, which in essence eliminates that
6 possibility of in essence steady autocatalytic
7 reaction due to concentration of the nitric acid. So
8 we're going to have a strong nitric acid scavenging
9 agent to eliminate the previous events that have
10 occurred, in essence.

11 DR. FORD: Okay.

12 MR. TROSKOSKI: Next.

13 DOE's approach to controlling possible HAN
14 reactions can be found in their technical report
15 EH0555 that was issued in the '98 -- it contains a
16 number of specific recommendations and it correlates
17 process temperature with an instability index, which
18 is a function of nitric acid molarity, the nitric acid
19 to HAN molarity of the iron.

20 The applicant has noted a number of
21 limitations when applying the index to its process, as
22 considering other strategies previously discussed.

23 The staff that use of the index and
24 associated recommendations may be an acceptable
25 strategy if applicability of each item is validated

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1 for the specific process. The DOE approach provides a
2 number of valuable insights that merit consideration.
3 However, the staff does recognize that alternative
4 strategies may provide the same or greater level of
5 safety.

6 The applicant has proposed a number of
7 strategies for three distinct process applications,
8 each with its own set of PSSCs as outlined in the
9 revised Construction Authorization Request. However,
10 the applicant is still considering a hydrazine
11 scavenging approach and has indicated that additional
12 information with this approach will be submitted to
13 the NRC for review. We have not received that
14 information yet.

15 CHAIRMAN POWERS: Let you finish, and then
16 I'll ask you the question.

17 MR. TROSKOSKI: Oh, okay.

18 This issue remains open pending
19 finalization of DCS's approach. If they choose to
20 implement the revised CAR approach, the staff still
21 needs to review the PSSCs design basis values and
22 ranges of values, such as concentration, pressure and
23 temperature limits.

24 And that pretty much concludes what I have
25 to say. So my presentation's over.

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1 Fire away, please.

2 CHAIRMAN POWERS: A couple of questions.

3 First of all, you're going to have to look
4 at a lot of things here. You have any quantitative
5 tools to help you look at these flow streams that
6 they're passing through? I mean do you chart an ASPEN
7 model on this or something like that?

8 MR. TROSKOSKI: We do have a risk group,
9 and we are thinking of a number of things such as
10 doing our fault tree analysis.

11 CHAIRMAN POWERS: How about setting up a
12 flow model here?

13 MR. TROSKOSKI: That certainly can be
14 explored, as though right now we still don't have the
15 detailed --

16 CHAIRMAN POWERS: Yes, you don't have
17 anything now.

18 MR. TROSKOSKI: Yes.

19 CHAIRMAN POWERS: I was just wondering if
20 -- I mean, you've got things where you have some great
21 data and things like that here.

22 MR. TROSKOSKI: Oh, yes. We're given the
23 chance to do some independent calculations and
24 reviews. So we certainly intend to.

25 CHAIRMAN POWERS: I don't know if this

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1 deserves setting up something as sophisticated as an
2 ASPEN model, but something of that nature.

3 The other question is in the course of the
4 discussion we hit upon this idea of silver azide
5 precipitating. Have you given that any thought?

6 MR. TROSKOSKI: The azides, I believe, is
7 still one of the open issues.

8 Alex?

9 MR. MURRAY: Yes. Just to let you know, we
10 have reviewed that aspect, and the nitrite -- I should
11 say the azides will be destroyed by nitrite before
12 they'd be able to be contacted with silver nitrate.
13 And the applicant has identified controls to render
14 such an event highly unlikely.

15 CHAIRMAN POWERS: I mean, all that works
16 well when the system works well. What about when the
17 system doesn't work well?

18 MR. TROSKOSKI: Well, you're back to your
19 Hazard Analysis. You're back to doing your Process
20 Hazard Analysis on a component-by-component basis. You
21 know, what happens if.

22 CHAIRMAN POWERS: Again, let me
23 hypothesize that.

24 MR. TROSKOSKI: Sure.

25 CHAIRMAN POWERS: I've got a saul of

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1 silver azide floating around in my solution. Does the
2 azide get destroyed, these particulate of the azide
3 get destroyed by the nitrous acid then with an
4 efficiency such that it doesn't pass on through the
5 system?

6 MR. KLASKY: Dana, let me add some insight
7 into all this.

8 The quantity of silver azide, of course,
9 is limited by the quantity of hydrazoic acid that one
10 can produce, which basically we have developed a model
11 to quantify the quantity of hydrazoic acid that can be
12 produced in this stream.

13 The answer to your question in terms of
14 the efficiency, I think I'd mentioned to you that
15 coming out -- we're not taking credit for the
16 destruction of the azide per se in the oxidation
17 column. Rather, we define on sampling to ensure that
18 the azide not present.

19 CHAIRMAN POWERS: Here's what I'm asking
20 is, when did you know that you have a two phase saul
21 in your sampling process? I mean --

22 MR. KLASKY: Yes.

23 CHAIRMAN POWERS: You will?

24 MR. KLASKY: In terms of kinetics, just
25 look at the kinetic rates. Hydrazine is first

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1 destroyed by the nitrous acid. Hydrazoic acid is
2 destroyed next. Hydroxylamine is destroyed
3 subsequent. And furthermore, you'll have plutonium in
4 your stream.

5 If you have any hydroxylamine, that will
6 mean that you have plutonium III. So by inference,
7 one can conclude that one does not have azide -- this
8 is an approach that we're talking about. It won't have
9 azide based on the valent state of the plutonium.

10 CHAIRMAN POWERS: So what you're quoting
11 to me are kinetics for homogeneous reactions. And I'm
12 asking you what if I have a particulate there, does
13 the reaction rate -- I mean, do we know what it is?
14 Do we know that it's rapid, that it's commensurate
15 with the rate for the homogeneous species is
16 different? Do we get a --

17 MR. KLASKY: I think two things. I'd point
18 out that we'll have -- we'll obviously have a
19 concentration in solution as well, just an equilibrium
20 to establish between the solid or the precipitate and
21 the solution as well. But in terms of kinetic rates,
22 at this point we have not concluded that the
23 homogeneous reaction kinetics are acceptable. That's
24 something for us to look into.

25 One further point you had mentioned

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1 ammonium, Mark, is located. The source of the
2 ammonium.

3 MR. VIAL: Well, so we haven't talked
4 about another property of hydrazine. Hydrazine also
5 reduce plutonium IV to the trivalent state. And in
6 excess, while you have two placebo reactions, one if
7 you are in excess of plutonium IV, another one if
8 you're in excess of hydrazine.

9 If you're in excess of hydrazine, you can
10 produce one mol of ammonium that can therefore react
11 with your nitrate and form your ammonium nitrate.
12 That's a possibility.

13 This reaction, that's one of the reaction
14 we're going to investigate. But this reaction so far
15 from what we've seen so far is really slow compared to
16 the main reaction -- reaction of plutonium to
17 trivalent, plutonium by either ammonium -- we're
18 going to address this issue.

19 CHAIRMAN POWERS: Good.

20 DR. LEVENSON: Can I ask a question?

21 CHAIRMAN POWERS: Only one.

22 DR. LEVENSON: Okay.

23 CHAIRMAN POWERS: At a time.

24 DR. LEVENSON: What's the scope of this
25 nitric acid organic worry as far as your review? Does

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1 it include the chemical makeup areas of the plant
2 where there's no plutonium present, or is it only in
3 the process area?

4 Context to my question is that the first
5 really big bang that I'm aware of in 1944 blew one end
6 out of the 205 building and somebody pumped nitric
7 acid into a tank in the makeup area that happened to
8 have a heel of formic acid from a previous operation.

9 MR. TROSKOSKI: Okay. Now, if I'm not
10 mistaken --

11 DR. LEVENSON: I assume a plant like this
12 has a chemical makeup area.

13 MR. TROSKOSKI: They will. And the --
14 what's the name --

15 DR. LEVENSON: By the way, I'm not
16 implying it should be. I'm just trying to find out
17 what your scope is.

18 MR. TROSKOSKI: Where they do make up the
19 reagents, it's not -- there is no licensed material in
20 it. And for that we are looking at, but it's --

21 DR. LEVENSON: So your scope did not
22 include that? There's no license material.

23 MR. TROSKOSKI: That part since it's not
24 licensed.

25 CHAIRMAN POWERS: But the requirements of

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1 Part 70 include chemical hazards.

2 MR. TROSKOSKI: Right. And if you look at
3 that, it's chemical hazards derived from licensed
4 material. It's chemicals like, for example, HF that
5 can be off-gased from UF 6 water reaction. But it's
6 not just your chemicals, unless they can affect the
7 safe operating and handling of licensed materials. IF
8 they can affect the control room, operations, which is
9 an important safety function, yes, then it's in our
10 jurisdiction.

11 MR. ROSEN: Well, that puts almost
12 everything in your jurisdiction, doesn't it?

13 MR. TROSKOSKI: Right. A lot.

14 MR. ROSEN: Very little of it falls out.

15 MR. KLASKY: Let me just clarify things a
16 little. We have performed two different analyses, the
17 concerns in the reagent building. A chemical release
18 in the reagent building we have to assure ourselves
19 does not create a possibility for a radiological
20 release in our AP process building. So we've performed
21 the chemical evaluations.

22 In addition, we've performed external
23 explosion analyses that address the possibility. In
24 the reagent building we have higher concentrations of
25 hydroxylamine and also hydrazine. And so consequently

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1 we have to assure ourselves that they cannot effect
2 the process building.

3 Within the AP process, I think Bill
4 alluded to the fact that our intention is to change
5 our reagent tank to include hydrazine. So the concern
6 of having hydroxylamine nitrate alone in conjunction
7 with nitric acid is diminished due to the presence of
8 the hydrazine.

9 CHAIRMAN POWERS: I can't help but comment
10 in that area of the country with people so attuned to
11 stock cars, there'll be a great deal of experience
12 dealing with hydrazine.

13 Any other questions for Bill?

14 Okay. Let's move on to fire.

15 Lary, you have to explain to Dr. Kress
16 that we're talking about "far" here.

17 MR. ROSEN: And "rad all."

18 DR. KRESS: But I know about this
19 hydrazine.

20 MR. ROSENBLOOM: Good afternoon. My name
21 is Lary Rosenbloom, I'm the lead fire protection
22 engineer on the MOX fuel fabrication project.

23 And my page turner is Tom St. Louis, who
24 is the lead mechanical engineer.

25 What I'd like to do for you today is give

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1 you a high level look at what the design of the fire
2 protection systems are at the facility and also the
3 program --

4 CHAIRMAN POWERS: You know, when I began
5 this Subcommittee meeting I raised the issue of how
6 you approach defense-in-depth for fire protection. And
7 in particular your definition of defense-in-depth for
8 fire protection. Will you go into that in the course
9 of this presentation?

10 MR. ROSENBLOOM: It wasn't the intent, no.

11 CHAIRMAN POWERS: No. Okay. Okay. Can
12 we do so?

13 MR. ROSENBLOOM: Well, are you coming at
14 this from the fire -- defense-in-depth sense of a
15 nuclear power plant? Because the nuclear power plant
16 defense-in-depth is a different definition than
17 defense-in-depth is utilized here.

18 CHAIRMAN POWERS: Well, what I know for
19 sure is your definition of defense-in-depth and that
20 that's in Appendix R of 10 CFR Part 50 are two
21 different things.

22 MR. ROSENBLOOM: Right.

23 CHAIRMAN POWERS: And they're pretty
24 similar up until we get to the third step. And in
25 your third step of your definition you say, and will

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1 extinguish the fire. Okay. Whereas the third step in
2 Appendix R says and we will make sure that while this
3 fire smolders away, we don't get any damage to
4 equipment, we will prevent damage to the equipment.
5 And I wondered why you took this obvious distinction
6 between the two?

7 MR. ROSENBLOOM: I guess I don't see those
8 distinctions like you're saying it.

9 The defense-in-depth nuclear power plant
10 is basically the fact that there is multiple levels of
11 protection. It isn't just a single feature that they
12 use for fire safety. They got fire prevention, fire
13 detection, fire suppression; all those work together.
14 That what's defense-in-depth of a nuclear power plant
15 is.

16 For defense-in-depth as regards to this
17 facility, is the defense-in-depth that applies to the
18 IROFS. For our facility, really, that's restricted to
19 those detection suppression systems that are located
20 in areas where we have dispersal of radioactive
21 materials.

22 So there's two different meanings
23 entirely, as I see it.

24 CHAIRMAN POWERS: Okay. Your first level
25 of defense-in-depth is to prevent fires. Your second

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1 is to detect and suppress.

2 MR. ROSENBLOOM: Right.

3 CHAIRMAN POWERS: Then your third is, you
4 say, and extinguish the fire. Okay. What I'm asking
5 here is that in our reactor world when we look at
6 these fires, we start -- the first step we say is
7 prevent the fires. That's the first step.

8 The second one is to detect and suppress.

9 And then we say and in the interim make
10 sure that the fire -- prevent it from damaging
11 equipment, which what we mean is safety equipment in
12 this case. Your equivalent to IROFS.

13 MR. ROSENBLOOM: Right.

14 CHAIRMAN POWERS: Okay. What I'm asking
15 is why didn't you say that? Why didn't you say that
16 while I'm waiting for this fire to be -- to
17 extinguish, that I'm going to make sure I don't get
18 any other IROFS damaged by this process?

19 MR. ROSENBLOOM: Well, you can have damage
20 to the IROFS. In the Fire Hazard Analysis we look at
21 the damage that could occur to those IROFS and see
22 what the effects are of that. Because in general for
23 the IROFS we have where you have redundancy. And if we
24 have a fire that takes out those particular IROFS, a
25 redundant set is available elsewhere.

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1 CHAIRMAN POWERS: Okay. I think we'll
2 explore this as we go kind of system-by-system.

3 That does bring you up nicely to the next
4 question I have, is one of circuit analysis in this
5 system. How do you view fire in circuit and in your
6 electrical circuits in these systems?

7 MR. ROSENBLOOM: Well --

8 CHAIRMAN POWERS: And here's where I'm
9 coming from. For just about everything else, when we
10 look at a facility, we look at does the IROFS, in this
11 case, it either works or it doesn't work. And we
12 analyze it accordingly.

13 With fire we have the potential of systems
14 working, but working badly. And does that come in
15 into your fire analysis? That's basically what I'm
16 asking you.

17 MR. ROSENBLOOM: Well, it does because the
18 routing of the IROFS, the electrical routing of the
19 IROFS is such that they are kept in separate areas.
20 But where they happen to be in the same areas, we do
21 analyze them and show that the situation is
22 acceptable.

23 CHAIRMAN POWERS: Okay. Please go ahead.

24 MR. ROSENBLOOM: Okay. The big picture I
25 want to get into is basically give you an overview of

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1 design, an overview of the program. We already started
2 getting into what the Fire Hazard Analysis is all
3 about, some fire modeling, talking more in depth about
4 our fire barriers, summarizing what our fire safety
5 strategy and concluding.

6 Well, the primary features as I would
7 think is our -- we have multiple fires areas facility
8 with all the barriers rated for at least hours. Now
9 those ratings are based upon ASTM E-119 definitions.
10 And the whole purpose of the fire is to keep the fire
11 to that origin. Now, these fires areas are structural
12 barriers that segregate the fire is, and there's about
13 300 fire areas.

14 In addition, we have the automatic
15 detection systems and we have an automatic and manual
16 fire suppression.

17 CHAIRMAN POWERS: ASTM E-119 tells you
18 whether a fire barrier qualifies to be 2 hour or 1
19 hour, or 10 minutes, whatnot. Why did you pick 2
20 hours?

21 MR. ROSENBLOOM: Well, because when we
22 looked at the facility in France and saw the ratings
23 they had over there, we saw that basically there were
24 little fire loads throughout.

25 Also, so the 2 hours seemed acceptable.

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1 And also when you look at the requirements themselves,
2 when it comes to definition of fire areas, the typical
3 number you see is the low number is 2 hours. So that's
4 why by definition I'm saying a fire has minimum fire
5 barrier rating of 2 hours.

6 CHAIRMAN POWERS: What's the total
7 inventory of dodecane in this facility?

8 MR. ROSENBLOOM: Total?

9 CHAIRMAN POWERS: Yes.

10 MR. ROSENBLOOM: Total quantity off the
11 top of my head.

12 CHAIRMAN POWERS: A 1,000 pounds?

13 MR. ROSENBLOOM: Probably in any single
14 fire area, probably that's the maximum.

15 CHAIRMAN POWERS: Yes. Is 2 hours
16 reasonable for a 1,000 pounds of dodecane?

17 MR. ROSENBLOOM: Considering how it's
18 stored. Basically it's in welded containers. That's
19 where you have the maximum quantities happens to be in
20 process cells where there's no chance of a fire
21 occurring in there anyway, because there's no ignition
22 sources.

23 CHAIRMAN POWERS: Okay.

24 MR. ROSENBLOOM: Now the large number of
25 fire areas I've shown here by just showing the first

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1 floor of the MOX processing building and also the
2 shipping and receiving building. And as you see on
3 the first floor, we have 18 fire areas, and we have 65
4 fire areas on the first floor of the MOX processing
5 area.

6 The next slide just shows an enlargement
7 showing how the fire areas all over the place and
8 they're well separated.

9 Going on, fire detection systems. We have
10 fire detection systems throughout the facility. And
11 those are basically working from the gloveboxes
12 outward. We have them within the gloveboxes. And then
13 the rooms surrounding the gloveboxes. And also we have
14 them in exhaust plenums of the process cells because
15 we don't have anything electrical in the process cells
16 themselves.

17 Now, suppression types, again, working
18 inward -- working from the glovebox out, we have a
19 portable carbon dioxide bottles that we can use to
20 manually suppress a fire inside the glovebox. In the
21 rooms we have the clean agent. And working out into
22 the corridors and stairwells, we have a water based
23 systems. And then we fire extinguishers throughout.

24 MR. ROSEN: What is this clean agent? IS
25 that like Halon?

1 MR. ROSENBLOOM: That's -- no, it's a
2 substitute for Halon.

3 MR. ROSEN: Well, I meant that, yes.

4 MR. ROSENBLOOM: That's what it is, it's
5 a substitute for Halon. When they talk about clean,
6 they're talking about clean environmentally.

7 MR. ROSEN: Right. And what kind of
8 substitutes are you talking about?

9 MR. ROSENBLOOM: What we're using
10 specifically at our facility, it's called Intergen.
11 Intergen.

12 MR. ROSEN: Have you looked at the
13 interaction of that substance with the process
14 materials?

15 MR. ROSENBLOOM: It's inert. It has
16 nothing that can interact. It's carbon dioxide,
17 nitrogen and argon.

18 MR. ROSEN: Okay.

19 MR. ROSENBLOOM: On the carbon dioxide
20 systems, again, those are for suppressing fire inside
21 gloveboxes, and those are using basically carbon
22 dioxide extinguishers that are being modified to be
23 able to inject at quick connects. And in order to make
24 sure I'm compliant with the intent of suppressing
25 incipient fires, the travel distance to these

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1 extinguishers met NFPA 10 requirements.

2 Like I said, those are in the process
3 areas. Now, the cleaning agent will be Halon free.
4 The reason it's Halon free is for process reasons
5 because -- things that are not halogen free could
6 impact the -- adversely impact the product, let's put
7 it that way.

8 The storage containers, the clean agent
9 bottles, they're stored throughout the facility but
10 they're kept in the vicinity of the hazard. And
11 because we have a decentralized system, we have
12 multiple storage locations.

13 Water-based systems, like I said, those
14 are in corridors and stairwells. And we're using a
15 preaction system so we can maximize criticality
16 safety. These are not located in any of the process
17 areas.

18 In order to get one of these systems
19 going, normally, you basically have to have a
20 detection. And then once you get the water flowing
21 into the pipe, then you have to have one of the heads
22 actually reach the heat which defuse the leak melts
23 and the water starts flowing.

24 And also in support of the need to
25 maximize criticality safety, we're using dry stand

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1 pipes instead of the normal wet stand pipes you'd
2 find.

3 The water for all this is connected via a
4 loop that we have around the whole facility to the
5 Savannah River site in that area, which also is a loop
6 system. And this has been sized to handle the biggest
7 demand plus a 500 gpm hose strength.

8 CHAIRMAN POWERS: You consider seismically
9 induced fires?

10 MR. ROSENBLOOM: That issue has been
11 brought up. And it's been asked by the DOE and we've
12 had back and forths about that. Basically what we've
13 concluded is that their concern is addressed by the
14 clean agent systems that are going to be providing
15 suppression in those areas that have dispersal of
16 radioactive material. And those systems do the seismic
17 qualification will be available in a post-seismic
18 event.

19 CHAIRMAN POWERS: But your water systems
20 are not going to be available?

21 MR. ROSENBLOOM: That's correct. The water
22 systems are not.

23 CHAIRMAN POWERS: But you think your clean
24 agents will be?

25 MR. ROSENBLOOM: Excuse me?

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1 CHAIRMAN POWERS: Your clean agents will
2 be but the water won't be?

3 MR. ROSENBLOOM: That's correct.

4 CHAIRMAN POWERS: Presumably the bottles
5 are? The CO₂ bottles are available?

6 MR. ROSENBLOOM: Oh, yes. Because those
7 are just -- now they're just like your extinguisher --
8 your portable extinguishers are.

9 CHAIRMAN POWERS: Yes. Okay.

10 MR. ROSENBLOOM: Okay. So that was
11 basically it for the systems. The other part, of
12 course, is the program that's in place. The main
13 focus is employee training we have in place. And that
14 basically covers what a person would do in the event
15 if they find a fire, actions, also training on what
16 they do if they see some type of fire event and see if
17 they can help extinguish it, put it out and call
18 certain people.

19 The other part is the fire brigade, which
20 provides on-site support for our fire fighting
21 activities. And that's would be a fire brigade in
22 accordance with NFPA 600. Have a fire brigade leader
23 and fire brigade members.

24 MR. ROSEN: I'm surprised that you don't
25 mention the Savannah River area fire brigade, or there

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1 is more backup? Why do you have a specific fire
2 brigade for this facility?

3 MR. ROSENBLOOM: We did a baseline needs
4 assessment to see if they could -- see if the site,
5 the Savannah River site fire department could respond
6 in a timely fashion. And basically we concluded that
7 they could not. And for that reason we decided we had
8 to have our own fire brigade.

9 MR. ROSEN: Do you integrate the Savannah
10 River fire brigade with the MFFF fire brigade? Are
11 there provisions to integrate those two forces?

12 MR. ROSENBLOOM: Well, there will be
13 training as part of the requirements to have the
14 training between our fire brigade and the fire
15 department. They have to know enough in order to come
16 in and provide backup. So, yes, there will be
17 integration.

18 MR. ROSEN: Is that part of your program?

19 MR. ROSENBLOOM: It will be part of the
20 program, yes.

21 DR. LEVENSON: You're adjacent or very
22 close to the pit disassembly and conversion facility,
23 right?

24 MR. ROSENBLOOM: That's correct.

25 DR. LEVENSON: By implication are you

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1 saying that the site fire department can't get there
2 in time?

3 MR. ROSENBLOOM: I'm not saying anything
4 about PDCF.

5 CHAIRMAN POWERS: And doesn't want to,
6 either. Can't speak for them.

7 MR. ROSENBLOOM: Can't speak for them,
8 that's correct.

9 All right. One of the main parts of the
10 fire protection program is the Fire Hazard Analysis.
11 What it is, documents the fire hazards, the fire
12 protection features and the overall adequacy of fire
13 safety at our facility based on a current design
14 information.

15 And you ask what goes into an FHA. Well,
16 quite a few things. Basically within the body of the
17 document you'll find out how fire is determined, how
18 we have fire safety with respect to our HVAC and
19 electrical design, it gives more details about the
20 fire protection program, goes into greater detail
21 about the fire water supply and manual fighting
22 capability. It talks about life safety, fire
23 exposures, potential for fire spreading from one area
24 to another. The impact of natural phenomena hazards on
25 the systems, like you'd mentioned about the post-

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1 seismic event. Compensatory measures.

2 We summarize our conclusions by comparing
3 also to the Appendix D of the SRP. And also as an
4 appendix to the whole document there's an area-by-area
5 analysis.

6 In each of those analyses -- if you're
7 looking for meat about any particular area, it gives
8 a description of what goes on in any area, the fire
9 hazards within that area, the ignition sources within
10 that area, the fire protection features as I've
11 described them to you. It also identifies and
12 evaluates the principle SSCs that you spoke of. It
13 goes into design basis fire scenarios and consequences
14 and also does a brief life safety analysis.

15 CHAIRMAN POWERS: Do you have and do these
16 fire hazard analyses a frequency versus size of the
17 fire?

18 MR. ROSENBLOOM: No. Not frequency, but
19 size yes.

20 CHAIRMAN POWERS: Size but not frequency?

21 MR. ROSENBLOOM: That's correct.

22 CHAIRMAN POWERS: Okay. So you're
23 basically saying I have a fire with probability one.

24 MR. ROSENBLOOM: Correct.

25 CHAIRMAN POWERS: And it can be big enough

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1 to damage a quarter or a half or a third of this area?

2 MR. ROSENBLOOM: That doesn't happen.
3 Because of the lack of continuity of combustibles in
4 this facility, we basically have a fire that would
5 start in a panel, a motor and whatnot. And because of
6 the low heat releases rates you would have and the low
7 heat fluxes, it basically starts there and stops
8 there. That actually goes into the next slide.

9 What we found so far in design is that the
10 fire safety design meets the applicable requirements
11 and the intent of the NFPA standards and national
12 building code. Like I said, the potential fires were
13 small, nonpropagating so basically we keep our fires
14 as we desired, within the fire of origin. And it was
15 also, as an add on, it was a management decision as a
16 defense-in-depth to the fire barriers to make those
17 detections and suppression systems in areas that had
18 dispersal materials the principle SSC.

19 MR. ROSEN: I presume you've done a
20 catalogue of all the process materials that we've been
21 talking about all day today?

22 MR. ROSENBLOOM: If they're combustible,
23 yes.

24 MR. ROSEN: And assured yourselves that
25 the process materials are not combustible?

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1 CHAIRMAN POWERS: Oh, the process
2 materials are very combustible.

3 MR. ROSEN: Oh, okay. Then why do we have
4 potential fires of small and not propagated?

5 MR. ROSENBLOOM: Because where the fires
6 start, they don't spread.

7 MR. ROSEN: They're not small, though?

8 MR. ROSENBLOOM: They are small.

9 MR. ROSEN: You spill tributyl phosphate
10 on the floor and it hits an ignition source and that's
11 a small fire? We're talking about terms here. I don't
12 know what you mean.

13 MR. ROSENBLOOM: We're talking about with
14 the normal configuration.

15 MR. ROSEN: Is tributyl phosphate
16 flammable?

17 MR. ROSENBLOOM: It's combustible, yes.

18 MR. ROSEN: Combustible? Okay. So now
19 you spill it on the floor and you have an electrical
20 gear in that room which happens to change state, so
21 you get an ignition source. What happens?

22 MR. ROSENBLOOM: Well, now you're talking
23 about the -- that's not a normal fire as it would
24 occur. But that aspect is dealt with by taking all of
25 the combustibles in an area anyway, even though it's

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1 not going to happen and assuming those all burn and
2 assuring the fire barriers are adequate to contain
3 that fire.

4 MR. ROSEN: What do you mean it's not a
5 normal fire? I don't get it.

6 MR. ROSENBLOOM: Because the fire starts
7 with the ignition source. But that aspect that you
8 were dealing with anyway is part of the conservatism
9 of our analysis is dealt with to consider all the
10 combustibles in an area as being --

11 MR. ROSEN: So you want to take my
12 postulate and turn it around and say, first, we have
13 an ignition source? First we have a sparking relay or
14 something like that?

15 MR. ROSENBLOOM: Right.

16 MR. ROSEN: And then -- or at the same
17 time you have a serious leak of one of these
18 combustible materials? I mean, you're just arguing
19 about what happens first? But you get to the same
20 place. You get an ignition of one of these flammable
21 materials?

22 MR. ROSENBLOOM: Right. And the concern
23 there is still going back to ensuring the affects of
24 those fires are maintained within that fire area. But
25 what's looked at in the Fire Hazard Analysis is what--

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1 where the fire can credibly start on its own, not with
2 all these conditional accidents coming into play.

3 CHAIRMAN POWERS: One of the things that
4 puzzled me about your characterization of the fire is
5 starting and not propagating. I harken back to an
6 event we had at the San Onofre plant where we had an
7 electrical equipment cabinet fire. Not an unusual
8 event.

9 MR. ROSENBLOOM: Right.

10 CHAIRMAN POWERS: It propagated right to
11 the next cabinet, to the next cabinet, to the next
12 cabinet. Do you recognize that sort of problem?

13 MR. ROSENBLOOM: I recognize that that is
14 a possibility and I deal with that by checking to
15 ensure that if I could burn all the combustible in a
16 room, that the fire barriers would contain all that
17 material burning.

18 So, I mean there's two aspects that I know
19 we're dealing with here. One is everything in a room
20 going up, and that is done by checking to ensure the
21 combustible loading can be contained by the fire
22 barriers. But there's also the scenario of are fires
23 going to start and can they propagate.

24 MR. ROSEN: I have the sense that you're
25 ducking the question. I mean, that's -- you know, this

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1 sort of gets me to push the question some more.

2 I'm thinking of the possibility of a real
3 fire.

4 MR. ROSENBLOOM: Yes.

5 MR. ROSEN: Not these constructs you're
6 talking about. A real fire that starts because
7 there's a leak of these flammable materials in a room.

8 MR. ROSENBLOOM: Okay.

9 MR. ROSEN: It's leaking, it's been
10 leaking for a while.

11 MR. ROSENBLOOM: All right.

12 MR. ROSEN: And then it gets worse. This
13 is the way things happen. It just so happens that the
14 room is a fairly good sized room and it has a lot of
15 electrical and other equipment in it, something or
16 other of that is an ignition source to this leaking
17 flammable liquid that's in the process stream.

18 Now you have a good size fire going.

19 MR. ROSENBLOOM: Correct.

20 MR. ROSEN: Being fed by a process stream
21 that's leaking.

22 MR. ROSENBLOOM: Yes.

23 MR. ROSEN: And I'm asking whether you've
24 analyzed those kinds of circumstances? Looked at the
25 kinds of processed fluids that can leak into a room

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1 and what would happen if they did; not just about
2 taking a sterile room, say, a room like this with no--
3 you know, the flammables that are here. My jacket,
4 Pete's tie and the electrical gear; yes, they could
5 burn. But a room which is also being fed by a
6 flammable liquid?

7 MR. ROSENBLOOM: In a sense of addressing
8 that specific scenario, the answer is no.

9 MR. ROSEN: Why not? Isn't that the risk
10 we're dealing with?

11 MR. ROSENBLOOM: Because -- no. Because
12 I'm insuring that even if I could get everything in
13 that room to burn, the fire barriers can contain it.

14 MR. ROSEN: Everything in that room to
15 burn is the part I'm arguing with. It's not
16 necessarily just what's the room since this is a fire
17 that's being fed by a leak of the flammable fluids.

18 MR. SIEBER: But these process streams are
19 batch processes, right, as opposed, you know, some oil
20 tanker sitting off shore pumping fluid through the
21 plant? You know, there's a certain charge of reagents
22 and solvents that go in there, and that becomes the
23 fire load. Is that correct or not correct?

24 DR. LEVENSON: Well, I think the question
25 is when you say everything in the room, does that

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1 include the total contents of any tanks of organic
2 liquids in the room?

3 MR. ROSENBLOOM: It does. It does.

4 MR. SIEBER: And so in the --

5 MR. ROSEN: And still you say the fires
6 are small?

7 MR. SIEBER: Pardon?

8 MR. ROSEN: But I don't get a sense of
9 that being a small fire.

10 MR. SIEBER: Well, small is subjective.

11 DR. LEVENSON: The small -- it sounds to
12 me like you're defining small as being confinable
13 within your fire barriers. It won't breach your fire
14 barriers, is that your definition"

15 MR. ROSENBLOOM: That's -- well, two
16 different things here. Again, when I look to see if I
17 could burn all the combustibles in a room, I'm not
18 dealing with any specific fire scenario.

19 DR. LEVENSON: Right.

20 MR. ROSENBLOOM: Okay. I'm just saying if
21 I could get everything to burn. But then when I
22 actually look at where the fires can start, that's
23 where I'm saying that the fires are small and
24 nonpropagating.

25 MR. SIEBER: But there's a probability

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1 associated with that. There is some probability
2 somewhere that you could burn everything in the room.

3 MR. ROSENBLOOM: And for all fires, I look
4 at it anyway.

5 MR. SIEBER: Right.

6 MR. ROSENBLOOM: So in a sense I look at
7 as a --

8 MR. SIEBER: So you envelop that?

9 MR. ROSENBLOOM: Right.

10 MR. SIEBER: And so the statement as to
11 whether it's a big fire or a little fire is not
12 relevant to the hazard analysis? It's just a
13 conjecture that --

14 MR. ROSEN: And what you've said now is
15 what I thought you should have said, which is that the
16 fire loading includes all the combustibles in the
17 room.

18 MR. ROSENBLOOM: It does.

19 MR. ROSEN: Which includes all the
20 combustibles in the process?

21 MR. SIEBER: Right.

22 MR. ROSEN: The tanks in the room?

23 MR. ROSENBLOOM: It does, yes. Yes.

24 MR. ROSEN: As well?

25 MR. ROSENBLOOM: Yes.

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1 MR. ROSEN: Does it include a look at what
2 could drain into the room from other rooms if the room
3 itself has a failed tank and everything -- and it's
4 lower than things in adjacent room to which it's
5 connected by piping?

6 MR. ROSENBLOOM: I think that that's --
7 isn't that prevented?

8 MR. ST. LOUIS: All of our process vessels
9 have catch trays underneath of them.

10 Tom St. Louis with DCS.

11 All of our process vessels have catch
12 trays underneath them, drip trays to collect the
13 contents.

14 MR. ROSEN: Yes. So it's now burning in
15 the catch tray?

16 MR. ST. LOUIS: Right.

17 MR. ROSEN: And the catch tray's big
18 enough in every case to collect the entire contents of
19 the process vessel?

20 MR. ST. LOUIS: Yes. Now, this is a batch
21 operation, as you mentioned. And most of our
22 quantities are very small, typically 55 to 75 gallons-

23 -

24 DR. LEVENSON: Criticality keeps --

25 MR. ST. LOUIS: Pardon?

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1 DR. LEVENSON: Criticality.

2 MR. ST. LOUIS: Yes. For instance the
3 total organics in the AP process is about 20 liters.

4 MR. ROSEN: That's interesting, but it's
5 not what I was talking about.

6 MR. ST. LOUIS: Okay.

7 MR. ROSEN: I was talking about 2 tanks in
8 adjacent rooms. The room with the low tank is the one
9 with the piping failure or crack, or whatever occurs.
10 And that tank drains into, I know, it catch tray now.
11 But there's another tank in another room adjacent to
12 it which drains by gravity into the room where the
13 fire has occurred, overflowing the catch tray,
14 etcetera?

15 MR. ST. LOUIS: Well, if there is two
16 tanks that drain by gravity and the failure of one
17 could drain both tanks, the catch tray is seized to
18 catch the total quantity.

19 MR. SIEBER: The catch tray doesn't cover
20 everything. For example, you've got to have
21 interconnecting piping. And I will bet you a floor
22 drain. So, the transport path is typically in
23 chemical liquid processes through the floor drains.

24 MR. KAPLAN: This is Gary Kaplan. Maybe
25 I can add some more to this discussion with the safety

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1 analysis.

2 What we have done is we looked at all the
3 radioactive material in each area where you could have
4 a fire and assume that was involved in the fire
5 regardless of the size. That's one of our basic things
6 we looked at.

7 And what we didn't look at was assuming
8 that you have a leak and a fire simultaneously as one
9 that you're postulating where you multiple things
10 happening, if the leak in one fire area results in a
11 fire, we would have that. But we wouldn't postulate
12 that you have multiple tanks leaking and then a fire
13 starts. We wouldn't have done that.

14 So what you're basically asking is, you
15 know, when Lary does his Fire Hazards Analysis he
16 assumes all the combustibles in that room are on fire
17 and his two or three hour fire walls can handle that.
18 What he didn't say was, well, I have 5 interconnected
19 tanks and is it possible that all those tanks could
20 end up in one area, one process cell and then I have
21 a fire simultaneous to that. We didn't analyze it
22 that way.

23 And let me add one more part, that
24 remember most of the liquids are in process cells
25 where there is no ignition sources. So we're talking

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1 just one or two areas where there's a couple of
2 gloveboxes where you have a mixer settler or a
3 dissolution unit and other area where there are
4 ignition sources.

5 So the scenario postulating where I have
6 multiple leaks and then a fire starting in a separate
7 area, we don't postulate multiple.

8 MR. ROSEN: I think you misunderstood the
9 scenarios.

10 MR. KAPLAN: Okay.

11 MR. ROSEN: Only one leak in my scenario.

12 MR. KAPLAN: Okay.

13 MR. ROSEN: It's in a, say, pump seal.

14 And the pump seal leak, maybe it has a tray underneath
15 it, which is okay. And that pump seal leaks and it
16 leaks enough to basically fill up the tray. And then
17 overflows the tray because it's being fed from another
18 room, not just what's in that room.

19 MR. KAPLAN: Right.

20 MR. ROSEN: Like through the piping from
21 another room.

22 MR. KAPLAN: You would detect that leak.

23 MR. ROSEN: And that leak catches fire.

24 And that's all. It's a simple thing. I think a
25 realistic case. And I'm asking whether that was

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1 analyzed. What's unrealistic about that?

2 MR. SIEBER: I sort of have a
3 misunderstanding, perhaps, of the way these cells are
4 constructed. But for a given process the cells in the
5 process equipment is not very big. I presume you'd
6 have it all in one room?

7 MR. ST. LOUIS: No. It's spread.

8 MR. SIEBER: It's spread around.

9 MR. ST. LOUIS: It's spread in multiple
10 rooms and in multiple fire areas. The equipment is
11 highly segregated.

12 MR. SIEBER: It's highly segregated?

13 MR. ST. LOUIS: Right.

14 MR. SIEBER: But it's connected together
15 with piping?

16 MR. ST. LOUIS: That's correct. And most
17 of our transfer means are airlifts.

18 Now there is, just responding to your
19 comment, there are no floor drains in these areas.

20 MR. SIEBER: Okay.

21 MR. ST. LOUIS: There is no
22 interconnecting floor drains that would transfer
23 fluids between rooms.

24 MR. KAPLAN: Let me go back to your
25 question are you worried about the radionuclide

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1 release or are you worried that the walls has 2 hour
2 barrier, 3 barrier is not significant?

3 MR. ROSEN: Well, the first step is to
4 worry about the fire. Have you bounded the fires that
5 could happen by your analysis technique. And it sounds
6 to me like you have not.

7 MR. KAPLAN: Well, you're assuming that we
8 have a leak that goes undetected and then a fire
9 occurs?

10 MR. ROSEN: Right.

11 MR. KAPLAN: That's your scenario?

12 MR. ROSEN: Right.

13 MR. KAPLAN: Right.

14 MR. ROSEN: And the leak is fed by more
15 than just the process fluids within that room?

16 MR. KAPLAN: Right. And we didn't
17 consider 3, 4, 5 multiple failures in a row --

18 MR. ROSEN: That's not a failure. Those
19 pipes are -- there's only one failure. I don't know
20 why you don't understand that.

21 MR. KAPLAN: Well, I have a failure to
22 detect the leak and a failure to --

23 MR. ROSEN: Oh, a failure to detect? Oh.

24 MR. KAPLAN: And also the failure -- and
25 also I have a fire that happens.

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1 MR. ROSEN: Well, the fire happens as a
2 consequence of the leak, that's what I'm proposing.
3 You only have one -- you do have a failure to detect
4 or you detect but you're not able to do anything about
5 it right away.

6 MR. KAPLAN: Yes.

7 MR. ROSEN: I mean detection doesn't
8 necessarily imply suppression.

9 MR. KAPLAN: I'm talking about detecting
10 the leak.

11 MR. ROSEN: Yes, detecting the leak.

12 MR. KAPLAN: As it occurs, right.

13 MR. ROSEN: But that doesn't imply
14 suppression. You know you have a leak. Okay. It's
15 tributyl phosphate or some other flammable liquid.
16 It's being fed by more than the process equipment
17 within that cell because there's more than one cell --
18 they're interconnected.

19 MR. VIAL: (Off microphone)

20 MR. ROSEN: Simple. Nasty but simple.

21 MR. VIAL: The piping is designed in such
22 a way that we prevent finding siphons. So we have
23 siphons breaks where needed and it's not possible to
24 keep on fitting through a leak within the plant.

25 MR. ROSEN: You have no pumping loops

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1 with--

2 MR. VIAL: We have pumping -- yes, we have
3 pumping. But in case we have pumping, we designed the
4 piping in such a way that it's not possible to prime
5 the siphon through the piping.

6 We have siphon breaks along the lines,
7 that is to say we are venting the lines in high
8 points. I don't think the lines you're mentioning is
9 credible.

10 DR. LEVENSON: Well, what's the total
11 volume in all connected tanks, pipes, etcetera at any
12 given time? Fifty gallons? Seventy-five gallons?

13 MR. ST. LOUIS: I don't have that number
14 off the top of my head.

15 DR. LEVENSON: It must be quite small,
16 though.

17 MR. ST. LOUIS: Well, it is. It's very
18 small. And the bulk of the material is in aqueous
19 material. It's not a solvent material.

20 DR. LEVENSON: I think, Steve, the thing
21 is unlike Hanford or Savannah River, the big plants,
22 the tanks are, you know, critically safe so they're
23 all quite small. So even if you drained them all, you
24 probably don't get much.

25 MR. ROSEN: Well, this is all support for

1 your statement that fires are small and not
2 propagating. It's a statement that there's no -- I
3 see no proof of that, just an ascertain.

4 MR. ROSENBLOOM: You'd have to read the
5 Fire Hazard Analysis.

6 MR. ROSEN: I suppose I'll have to.

7 MR. ROSENBLOOM: All right. Next slide.

8 We also do some fire modeling. The
9 primary reason we do fire modeling is to see the
10 impact of fire on these temperatures and heat fluxes
11 on specific targets for key fire events.

12 The secondary reason we do that is also to
13 insure we have an adequate safety margin with regard
14 to fire severity in relation to the ratings of the
15 fire barriers. And we include transient combustibles
16 within the fire models. And the codes we're using
17 right now are CFAST and FPEtool.

18 CHAIRMAN POWERS: Now, do these codes look
19 at the effect of fire on the performances of
20 electrical circuits?

21 MR. ROSENBLOOM: No, they don't.

22 CHAIRMAN POWERS: How do you handle that,
23 the performance of electrical circuits in a fire area?

24 I mean, the question is do you get
25 spurious actuations of things? Do strange things

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1 happen to you when you have an electrical circuit
2 exposed to a fire?

3 MR. KIMURA: Steve Kimura from DCS.

4 We'll be doing hot short analysis of the
5 electrical system in response to fire as part of the
6 ISA. Right now we have not considered multiple
7 independent failures of electrical equipment in
8 response to a fire. So I'm not sure exactly where
9 you're going with your question.

10 CHAIRMAN POWERS: Well, where I'm actually
11 going is out and around the barn and back again. What
12 you told me is that you're going to just -- your
13 electrical -- detailed electrical analysis, part of
14 your ISA. What I really want to understand is what's
15 the design basis for what's here. And the question
16 really is are you going to have an assured pathway
17 for shutdown regardless of where the fire take place?

18 MR. KIMURA: The design basis will be that
19 a single fire will not knock out both channels of a
20 safety system when we have a redundant channel. We
21 have in some instances more than two channels that
22 protect us.

23 CHAIRMAN POWERS: I hope in a lot of
24 instances.

25 The trouble is I never see it so clearly

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1 and starkly stated in the fire section as what you
2 did. I mean, what you said was fine. No single fire
3 will frustrate our ability to safely handle this
4 system. I never see it that it historically said, and
5 that's what I want when I'm looking at the design
6 basis here. So if you can put those words in nice and
7 stark, gosh I'd be happy. Because that's what I'm
8 worried about. Okay. That's what I'm worried about
9 on the defense-in-depth situation.

10 If it just came down to my design basis is
11 such no single fire's going to kill me here, then all
12 these questions would go away.

13 There's a lot of traditional fire
14 discussion. That's fine. I mean I'm used to that.
15 But I was really looking for a design basis here in
16 this regard. And that lovely statement that he made is
17 what I was looking for.

18 MR. ROSENBLOOM: Steve is good at doing
19 those kind of things.

20 The next slide has to do with dealing with
21 the issue of the robustness of our fire barriers. And
22 what I want to do is deal with the structural elements
23 of the buildings that are required to have type 1
24 construction per NFPA 220, which is the standard types
25 -- standard on types of building construction.

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1 Now, this type 1 construction applies to
2 our fuel fabrication building, our emergency generator
3 building and our emergency fuel storage building.
4 Basically what we have in these buildings is between
5 8 inches and up to 36 inches of reenforced concrete.

6 Now, when you look at the requirements --
7 well, I shouldn't say the requirements, but the
8 guidance from ACI, you can see that regardless of the
9 aggregate we use, that we have structural barriers
10 that are at least rated for 3 hours. And so we
11 conclude that our structural elements all have a fire
12 rating of at least 3 hours.

13 CHAIRMAN POWERS: And what you're saying
14 here is that you've set up a departments that no
15 single fire will be caused because of building
16 collapse, is that right?

17 MR. ROSENBLOOM: That's one aspect of it.
18 To me the other key aspect is insuring that a fire in
19 it will be contained to a single fire.

20 CHAIRMAN POWERS: And that really is your
21 design basis then? Is that any fire will be contained
22 in -- there's zero probability of going from one fire
23 area to the other?

24 MR. ROSENBLOOM: Correct.

25 CHAIRMAN POWERS: That's a tough design

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1 basis.

2 MR. ROSENBLOOM: There's a lot of fire
3 areas.

4 CHAIRMAN POWERS: A lot of fire areas, and
5 I was going to comment, you'll learn to regret making
6 so many fire areas.

7 MR. ROSENBLOOM: So, getting to summarize
8 what our fire safety strategy is. As we talked about,
9 we have lots and lots of fire areas, far in excess of
10 300. We have detection suppression for those rooms
11 containing disperse reactive materials to provide
12 defense-in-depth to those barriers. We do prevent
13 fire in certain locations in our process cells because
14 there are no ignition sources. We also have a
15 controlled combustible and controlled ignition
16 sources.

17 CHAIRMAN POWERS: I will comment to you
18 that that at the Savannah River site, and I know
19 that's not you, it's historically had a tremendous
20 difficulty with control of transient combustibles. I
21 mean, it seems to be a part of the culture there to --

22 MR. SIEBER: Safety culture.

23 CHAIRMAN POWERS: This is the transient
24 combustible culture here. I just comment.

25 MR. SIEBER: Well, I think it's my

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1 understanding that the protective systems here are
2 quite different than a power plant, for example.
3 You're trying to maintain ventilation to keep the
4 gloveboxes at a negative atmosphere, and so forth.
5 That would be difficult to prevent a failure of some
6 thing fan HEPA filter combination. Because you
7 probably only have one fan per box, right? But it's
8 not a radiological disaster if the fan shuts down. So
9 I presume that that's okay, right?

10 MR. ST. LOUIS: Well, I will be getting
11 into the ventilation in the next presentation, and the
12 number of fans and how it's all connected together.

13 MR. SIEBER: Yes. You'll let that answer
14 the equipment.

15 MR. ST. LOUIS: Well, I'm the guy, so --

16 MR. SIEBER: All right.

17 MR. ST. LOUIS: Hopefully I'll answer it
18 then.

19 DR. LEVENSON: Let me ask a question about
20 your definition of no ignition sources. Does that
21 mean that there's nothing electrical inside the room
22 or what is inside the room is explosive proof
23 electrical, or what? What does that mean?

24 MR. ROSENBLOOM: It's your former one.
25 There's no electrical devices within the room.

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1 DR. LEVENSON: No pumps, no motors, no
2 lights, nothing electrical?

3 MR. ROSENBLOOM: That's correct.

4 MR. ROSEN: No lights?

5 MR. ROSENBLOOM: That's correct.

6 MR. SIEBER: Well, some of your fire areas
7 are gloveboxes, right?

8 MR. ROSENBLOOM: Right.

9 MR. ST. LOUIS: Just a clarification.
10 We're just talking about one series of rooms in the
11 buildings and not all of the room.

12 DR. LEVENSON: Yes. No, no. But those
13 were did you say there were no ignition sources, let
14 me get a definition for what that meant.

15 MR. ST. LOUIS: There is no ignition
16 sources other than process fluids that inside welded
17 tanks, there's no combustibles in the room either.

18 MR. ROSEN: Now you said there were no
19 lights in these rooms.

20 MR. ST. LOUIS: That's correct.

21 MR. ROSEN: So when you go in to do
22 maintenance on them, on compliments in these rooms,
23 you would bring the lighting sources with you?

24 MR. ST. LOUIS: That's correct.

25 MR. SIEBER: There you go.

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1 MR. ROSEN: Very unusual.

2 CHAIRMAN POWERS: I don't know how unusual
3 it is for process facilities. I mean, that's not --
4 that's pretty common to have -- to have to bring your
5 own lighting. Of course, that means you bring your
6 own ignition sources, too. I mean, most of our fires
7 in process facilities occur when we're doing
8 maintenance.

9 MR. ROSENBLOOM: Again, talking about
10 multiple fire areas as to why we have those. Here's
11 some key factors here.

12 It limits our combustible loads so that we
13 contain -- contain them to a single fire and that
14 includes transient loads. It limits the extent of any
15 individual fire, of course. It limits the MAR, the
16 material at risk.

17 CHAIRMAN POWERS: Material at risk.

18 MR. ROSENBLOOM: Material at risk.

19 CHAIRMAN POWERS: And I wanted to ask you
20 about that, because I read one of them -- I'm sure I
21 read one of them that said there was -- the material
22 at risk was 890 kilograms. Yes, it's limited, but not
23 a very big limit.

24 MR. ROSENBLOOM: And the fact that we're
25 talking, again, about multiple fires that

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1 effectiveness of having multiple fires is shown by a
2 long history of fire safety, analysis and tests.

3 DR. KRESS: What kind of access do you
4 have for these rooms?

5 MR. ROSENBLOOM: Oh, the process cells?

6 DR. KRESS: Yes. Are there doors in
7 between?

8 MR. ROSENBLOOM: No. None normally. These
9 are cells that you'd only go into maybe once a year,
10 if likely.

11 CHAIRMAN POWERS: Once in a leap year is
12 more likely.

13 MR. ROSENBLOOM: And we're in the process
14 of actually designing those access ways. But just
15 think of them as removable panels that would be bolted
16 in place.

17 I mentioned the control combustibles
18 before. We control our combustibles and we limit
19 their use by using noncombustible and nonflammable
20 materials to the maximum extent possible. We use a
21 thermally stabilized form of our pyrophoric materials,
22 the plutonium oxide and uranian oxide, so it's
23 essentially noncombustible.

24 The sulton diluent we use in the process
25 of buildings are usually handled within welded

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1 equipment and it's a NFPA 30 compliment. And we use
2 fire retardant electrical insulation.

3 And as mentioned before --

4 CHAIRMAN POWERS: When you say fire
5 retardant electrical insulation, what particular
6 insulation are you talking about?

7 MR. ROSENBLOOM: IEEE 383.

8 As mentioned before, by controlling
9 ignition sources, we talked about restricting location
10 of electrical equipment. That applies to the process
11 cells. We don't have any. We ground all our
12 equipment. We also have a hot work permit system, as
13 you talked about, where maintenance is the most likely
14 place you're going to have a fire. WE have a hot work
15 permit system.

16 CHAIRMAN POWERS: How many fires have we
17 had at facilities with a hot work permit system?

18 MR. ROSENBLOOM: How many?

19 MR. ROSEN: It's equal to very close to
20 the total number of facilities that have had a fire.

21 CHAIRMAN POWERS: That's almost identical,
22 in fact. Per year.

23 MR. SIEBER: Well, it's to aid in figuring
24 out who started it.

25 CHAIRMAN POWERS: I didn't hear you, Jack.

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1 MR. SIEBER: It's an aid to figuring out
2 who started the fire.

3 CHAIRMAN POWERS: I think that's what it
4 is.

5 Go ahead.

6 MR. ROSENBLOOM: All right.

7 So in conclusion, we call it multiple
8 layers of fire protection. We have low combustible
9 loads, control our ignition sources, we have multiple
10 fire areas, we have our fire detection systems, fire
11 suppression systems, fire brigade and we also have a
12 fire prevention protection program in place.

13 Next slide.

14 CHAIRMAN POWERS: In the -- it may be
15 premature to ask this, maybe it's not, is there a fire
16 engineer on the staff of this facility?

17 MR. ROSENBLOOM: Right now?

18 CHAIRMAN POWERS: To be when it's built.

19 MR. ROSENBLOOM: It'll probably be me.

20 CHAIRMAN POWERS: Okay. That's good,
21 actually. I think --

22 MR. ROSENBLOOM: But also I can tell you
23 it's part of the fire protection program, there will
24 be a fire protection engineer on staff.

25 CHAIRMAN POWERS: Okay. Okay. Good.

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1 MR. ROSENBLOOM: Any questions?

2 MR. KAPLAN: This is Gary Kaplan again.

3 Steve, I'm uncomfortable with how we left
4 you on your question. I don't think we answered your
5 question fully. So I want to -- if you want to bring
6 it up again, I'd want to try to answer it.

7 MR. ROSEN: Well, I don't think you've
8 answered it.

9 MR. KAPLAN: Okay.

10 MR. ROSEN: But I -- the facility that has
11 numerous flammable fluids in it. And that while it's
12 true that it is designed to not have a lot of external
13 flammable or combustible materials, it does have
14 piping and it does have pumps and I presume it has
15 valves that are electrically controlled. So it must
16 have wiring and other stuff. And it has people, so
17 you know it can end up with errors being made and
18 stuff being left around.

19 And my feeling is that there are enough of
20 those sources that there ought to be a look at how
21 fires could be fed by more than just the combustible
22 loading within a given cell. And a look to see that
23 cells that are adjacent to a cell where a fire starts
24 for some reason, could not feed that cell with
25 additional flammable fluid through piping, and that's

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1 the question.

2 MR. KAPLAN: That's a reasonable request.
3 We'll -- I think we've covered that in our initial
4 analysis, but we'll go back and look specifically at
5 that and make sure that we handle that appropriately.

6 MR. ROSEN: And I hear a lot of the
7 cautions -- I appreciate that. And I hear a lot of
8 the cautions to my question which don't worry about
9 because this is a very small fire, and it's very --
10 there's not that much stuff. But even so --

11 MR. KAPLAN: Right no.

12 MR. ROSEN: -- you ought to go back and
13 look for it.

14 MR. KAPLAN: We'll look.

15 MR. ROSEN: And make sure you can't
16 exacerbate an existing fire.

17 MR. KAPLAN: Okay.

18 MR. ROSEN: Thank you.

19 CHAIRMAN POWERS: Any other questions to
20 the speaker?

21 In that case, I propose we take a 15
22 minute break and we'll come back and attack fire
23 again.

24 (Whereupon, at 3:58 p.m. a recess until
25 4:17 p.m.)

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1 CHAIRMAN POWERS: Let's come back into
2 session and have any discussion of fire protection?

3 Sharon Steele, are you ready to present?
4 I don't see Sharon. There she is. Sneaking up on me
5 again, aren't you?

6 And just DCS doesn't feel discriminated
7 against, Sharon, I'm going to ask you also to talk a
8 little bit about the defense-in-depth philosophy for
9 fire that DCS had adopted and what you understand
10 about their treatment of the effects of fire on
11 electrical circuits.

12 MS. STEELE: Okay. You mentioned in the
13 reactor role, defense-in-depth the objective is to
14 prevent fires from starting, detect them quickly and
15 extinguish them or control them, and to provide
16 protection for structures important to safe shutdown.

17 I believe DCS's main strategy would be to
18 confine any fires that occur. That's why they're
19 providing so many fire areas. They want to contain --
20 divide the combustibles into small amounts, contain
21 the fires to one fire area and certain areas they will
22 provide detection and suppression as defense-in-depth.
23 Those are treated as principle structure systems and
24 components, which may become IRAs.

25 And in terms of protection of structures

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1 important to safety, the main features I would think
2 of to compare that to the reactor world, would be the
3 exhaust systems that are provided for the gloveboxes
4 and the process rooms. In other words, these C3/C4
5 confinement systems, which are supposed to remain
6 operational during a fire. And those are active
7 systems. They are redundant systems and they are
8 provided with redundant electrical trains that come
9 into the building, into the facility and are separated
10 at least 150 feet apart when they enter and in conduit
11 inside the facility.

12 In terms of electrical fires, my
13 understanding and what we have the draft SER and the
14 first draft SER, I believe, is that electrical hot
15 shorts or faults would be detected in the systems.
16 And that there would be some sort of fault
17 interrupter. And those sort of initiators do not
18 propagate throughout the systems.

19 And so I feel that they are looking at
20 defense-in-depth from that point of view. They are
21 providing successive layers of protection at each
22 area, or at least they're attempting to do that.

23 CHAIRMAN POWERS: Do we have scenarios
24 where we fail the bust bar providing power to C3/C4 --

25 MS. STEELE: Well, we feel that they are

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1 not providing sufficient power?

2 CHAIRMAN POWERS: No. Where we lose all
3 ability to provide -- we would have a station
4 blackout.

5 MS. STEELE: Okay.

6 MR. WESCOTT: Let me answer that, Sharon.

7 MS. STEELE: Okay.

8 MR. WESCOTT: I'm Russ Wescott. And I'm
9 the ISA lead.

10 And, no, the C3/C4 systems are -- it's not
11 considered a credible accident to lose them, because
12 the number of redundance; fans, power sources. And I
13 think possibly probably Tim Johnson can talk a little
14 bit more about that when we -- in fact, he's ready to
15 right now.

16 MR. JOHNSON: For the C3 and C4 systems
17 there are four power supplies to those systems. The
18 normal system, the emergency, the standby system and
19 uninterruptable power supply. So for those to fail,
20 all four of those would have to fail.

21 CHAIRMAN POWERS: And the way to fail them
22 is fail the bust bar. The power comes into the
23 system.

24 MR. KIMURA: Steve Kimura, DCS.

25 There are two separate bust bars for each

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1 system, for the C3 and the C4.

2 CHAIRMAN POWERS: You guys have an answer
3 for everything, don't you? Here I come up with this
4 great idea and you're just -- okay.

5 MR. WESCOTT: Could I add one more real
6 quick one?

7 I was the person who wrote the fire
8 protection part of the SRP. And when we started
9 writing the SRP, we had a lot of discussions about
10 putting in Appendix R type requirements in this. And
11 we made a conscious decision not to, because we
12 thought the facility was considerably different from
13 a reactor, not only in design and combustible
14 loadings, but also in the basic objective of what
15 you're trying to accomplish with Appendix R as opposed
16 to the fire protection here.

17 So I think that's one of the reasons you
18 don't see the Appendix R type requirements here.

19 CHAIRMAN POWERS: I guess when you think
20 about -- when I think about it, it's hard for me to
21 believe that the combustible loads of this facility
22 are going to be less than those of the fire areas in
23 a reactor. I mean, it just seems implausible to me.
24 Steve, am I --

25 MR. ROSEN: No, and that's why I was

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1 pursuing this business that I was pursuing earlier.
2 You've got all of these flammable fluids around,
3 something we typically avoid in reactors except where
4 it's unavoidable.

5 MR. WESCOTT: Well, in course in reactors
6 you have a lot of pump lubricants. And, of course,
7 here your cable tray loadings and so on. I don't
8 think they're all that much different here. I mean,
9 they're significant here, they're significant in the
10 reactors.

11 MR. ROSEN: I think you can fires in
12 either. I mean, that's what you should conclude.

13 MR. WESCOTT: Sure. Sure.

14 MR. ROSEN: And then see what happens if
15 you have a fire. Now, what do you have a stake? Well,
16 here you have solutions bearing plutonium. That's
17 something you don't have in a reactor. And the
18 consequences of release of those solutions after you
19 have a fire, it could be quite significant.

20 MR. WESCOTT: Well, I'll let Sharon
21 address the different types of fire protection.

22 MS. STEELE: Okay. One area that Lary
23 talked about quite a bit was the Fire Hazardous
24 Analysis, which is a systematic approach to looking at
25 the combustibles in a particular area, looking at all

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1 the fire protection features that are provided in that
2 area and making a determination as to their adequacy.

3 I know that currently on NRR's side they
4 also used -- they're promoting Fire Hazardous Analysis
5 more often now, because in spite of whatever
6 requirements they have for Appendix R, they still have
7 to ensure that each particular fire scenario as they
8 come is addressed by the particular features in the
9 facility. And so I think the Fire Hazardous Analysis
10 is sort of a risk informed sort of tool that we
11 promote on this side, and particularly with Part 70,
12 or I should say with the SRP. And that is really the
13 way that more facilities are going.

14 MR. ROSEN: Well, I think that's great.
15 And just all I'm trying to do is make sure that the
16 right inputs that do that analysis are used.

17 MS. STEELE: Right.

18 MR. ROSEN: And I guess they heard earlier
19 that they might take another look at that and make
20 sure that they're not missing some of the right
21 inputs.

22 MS. STEELE: Right. And I have some open
23 items that could address some of that concern, too,
24 that they're still addressing.

25 So, can I go ahead?

1 CHAIRMAN POWERS: Please.

2 MS. STEELE: Okay. For those of you that
3 didn't hear, my name is -- well, it's up there.
4 Sharon Steele.

5 CHAIRMAN POWERS: Oh, I thought it was
6 Fire Protection Engineer.

7 MR. ROSEN: And you're still Sharon
8 Steele.

9 MS. STEELE: Yes. Yes. And I'm the fire
10 safety review for the MOX facility.

11 And my presentation today will focus on
12 the resolution of the status of open items that were
13 identified in the draft safety evaluation report that
14 was issued in April of 2002.

15 In a nutshell, there were four main areas.
16 WE've closed two items, and they pertain to the
17 glovebox window material and to the facility wide
18 system. However, we still have concerns regarding the
19 fire barriers and the soot loading analysis.

20 Our Standard Review Plan, NUREG-1718,
21 recommends that the facilities follow the applicable
22 guidance or requirements in the National Fire
23 Protection Association codes and standards. And in
24 particular, DCS -- the applicant has adopted NFPA 801
25 as a design basis for their facility.

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1 And NFPA 801 says that facilities shall
2 not use combustible materials for their glovebox,
3 including the glovebox windows. However, the
4 application is using polycarbonate in order to reduce
5 the seismic risk and overall risk at the facility.

6 In addition to the Construction
7 Authorization Request, the applicant submitted the
8 polycarbonate report, which is really formally know as
9 "The Choice of MOX Fuel Fabrication Facility Process
10 Glovebox Window Material," but we call it
11 polycarbonate report for short. And that report
12 indicated that polycarbonate had superior seismic
13 inertia and deflection properties when compared to
14 glass, which is allowed by code. And superior fire
15 protection properties when compared to other plastics,
16 such as polymethyl methacrylate, which had been used
17 in other similar facilities.

18 CHAIRMAN POWERS: I wonder what the
19 authors of NFPA 801 had in mind when they said none?
20 I mean, had they no experience with gloveboxes
21 whatsoever?

22 MS. STEELE: Yes. Well, one of the
23 concerns -- a lot of these requirements came out of --
24 because of a result of the Rocky Flats fires, where
25 the gloveboxes were in fact polymethyl methacrylate

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1 and Benelux and there were some significant fires
2 which led to contamination of the facility. And so
3 they felt that if you reduced the number of
4 combustibles, reducing the combustibles by design
5 through the use of noncombustible materials in the
6 gloveboxes, that that would go a long way to reducing
7 the fire hazard.

8 CHAIRMAN POWERS: Yes. But they -- the
9 trouble is that the term noncombustible.

10 MS. STEELE: Right.

11 CHAIRMAN POWERS: IF they're poorly
12 combustible or something like that -- limited
13 combustible capability.

14 MS. STEELE: Right.

15 CHAIRMAN POWERS: We would have gotten out
16 of the problem here. But they instead they used
17 something that drives you toward glass, which is
18 probably the worst thing to use.

19 MS. STEELE: One of the things about the
20 NFPA codes is that it encourages a lot of discussion
21 between applicant and regulator. And, for example,
22 there's a little caveat that says that if the
23 authority having jurisdiction allows you to do
24 something differently, then you may if you have
25 sufficient justification.

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1 CHAIRMAN POWERS: The problem is that it's
2 very misleading to a member of the public.

3 MS. STEELE: Yes.

4 CHAIRMAN POWERS: He comes along and he
5 reads this word noncombustible and he comes and he
6 says -- and the NRC allowed them to use this horrible
7 combustibile material, this carbon --

8 DR. LEVENSON: Not only that, but he used
9 combustibile gloves.

10 CHAIRMAN POWERS: Okay. Continue on.

11 DR. LEVENSON: Let me ask a question. When
12 the comparison was done to glass, was it done with
13 laminated safety glass or just plain glass?

14 MS. STEELE: Just plain, and the report
15 talks about plain glass.

16 DR. LEVENSON: Because see at Argonne for
17 many, many years they've used laminated safety glass.

18 MS. STEELE: Right.

19 DR. LEVENSON: Which does answer the
20 seismic thing, etcetera.

21 MS. STEELE: This is just a picture for
22 those of you who are not familiar with gloveboxes,
23 showing a typical installation. I believe this one is
24 from the MELOX facility.

25 As a result of the information in the

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1 polycarbonate report, we've requested that the
2 applicant provide a design basis criteria to assure
3 that the mechanical fire and seismic properties as
4 stated in the polycarbonate report were in fact
5 bounding and valid for the end use of the gloveboxes.

6 In reading the construction authorization
7 report requests, we determined that there were
8 additional protective features provided for rooms that
9 contained gloveboxes, such as automatic detection and
10 suppression systems, which were already described.
11 These are principle structure systems and components.
12 There are manual -- the operators are able to use CO₂
13 manual injection ports that are in the gloveboxes to
14 suppress incipient stage fires.

15 Most of the gloveboxes are inerted with
16 nitrogen, and that helps with -- helps to reduce the
17 fire hazard.

18 And also the applicant is proposing
19 combustible loading controls as a principle structure
20 system and component for gloveboxes that store large
21 amounts of radiological material.

22 When we looked at the Fire Hazards
23 Analysis we determined that polycarbonate was in fact
24 accounted for in their analysis. And that helped with
25 our accepting the use of the polycarbonate glovebox

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1 material.

2 Also, the applicant has agreed to evaluate
3 in the safety analysis whether the values provided in
4 the polycarbonate report are bounding for the expected
5 us, and they will look at normal operating conditions
6 such as material creep due to excessive temperatures,
7 radiation and aging.

8 As a result, NRC considered the
9 polycarbonate material as a candidate material for use
10 at the facility.

11 And just -- I'm sorry.

12 MR. SIEBER: Do you have any gloveboxes
13 that the fire is in and of themselves?

14 MS. STEELE: That a fire zones in those
15 areas?

16 MR. SIEBER: Zones.

17 MS. STEELE: No. The gloveboxes would be
18 contained within a fire area.

19 MR. SIEBER: But they in themselves are
20 not the boundary of a fire area?

21 MS. STEELE: No. They're not the boundary
22 of the fire area. In fact, in their safety assessment
23 they assumed that if there is a fire inside of the
24 gloveboxes, that the glovebox would be consumed by the
25 fire.

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1 MR. SIEBER: Disappears? Yes. Okay.

2 MS. STEELE: And Lary just showed me a
3 sample of polycarbonate. This one had the propane
4 torch exposed to it for 30 seconds. I can pass it
5 around.

6 MR. ROSENBLOOM: Self-extinguishing.

7 MS. STEELE: Right. I don't like to use
8 that term, but if you remove the flame from the
9 polycarbonate, it does not sustain combustion. I have
10 numbers on the ignition temperature. The self-ignition
11 temperature is over 1000 degrees F for polycarbonate.

12 CHAIRMAN POWERS: These gloveboxes use
13 aluminum?

14 MS. STEELE: They are stainless steel. The
15 frames are stainless steel. And they follow -- what is
16 it? ANSI N-690 criteria.

17 The next item that was open had to do with
18 the propagation of hot gas through the pneumatic
19 transfer systems. And these systems carry materials
20 throughout the facility, usually in convenience cans
21 or sample vials between the gloveboxes. So they go
22 across process atmospheres.

23 And the last time I was here I think
24 someone likened it to driving up to a bank teller and
25 withdrawing money.

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1 So, the concern was that hot gases could
2 be transported across fire area boundaries.

3 These transfer tubes are composed of
4 double wall piping, and while that offers some
5 protection against fires, the revised CAR indicated
6 that the applicant would be providing combustible
7 loading control as a PSSC in the rooms that contain
8 these automatic transfer systems.

9 They have also committed to analyze in the
10 integrated safety analysis the impact of hot gases
11 being transported throughout the tubes. And they will
12 determine where isolation valves could be required and
13 if so, they would provide them as IROFS.

14 DR. KRESS: What kind of gases do they
15 use?

16 MS. STEELE: Just hot gas -- smoke and gas
17 from a fire.

18 DR. LEVENSON: No, the transport gas.

19 MS. STEELE: I'm sorry?

20 DR. LEVENSON: The transport gas.

21 DR. KRESS: The transport system. What's
22 the propellant gas?

23 MS. STEELE: Oh. Oh, I don't know. For
24 the vacuum system. Does anyone know what that is?

25 MR. ST. LOUIS: Tom St. Louis. DCS.

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1 It's just ordinary air. They have blowers
2 that provide motive power.

3 DR. LEVENSON: How does that interface
4 with the glovebox as it has inert atmospheres? Do
5 they vent into those boxes?

6 MR. ST. LOUIS: No. There's a seal where
7 you introduce the vial into the transport system. It
8 is like the bank system. You transport a container and
9 the principle purpose of it is to move samples from
10 the gloveboxes to the lab.

11 MR. ROSEN: So you take the sample out of
12 the glovebox, put it in this pneumatic container and
13 put that -- you don't transport directly from the
14 glovebox?

15 MR. ST. LOUIS: No. There's a seal. And
16 you do transfer it inside the glovebox.

17 MR. ROSEN: Well then Milt's question is
18 not answered. The glovebox has an inert atmosphere
19 and the pneumatic tube has air.

20 DR. LEVENSON: What does it have, a little
21 airlock or something?

22 MR. ST. LOUIS: Yes, it has a little
23 airlock.

24 DR. LEVENSON: So if it has an airlock,
25 then hot gas is moving down the system don't

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1 automatically get into the other gloveboxes?

2 MS. STEELE: Right. Not automatically.
3 But that is something that we want them to evaluate,
4 wanted them to evaluate --

5 DR. LEVENSON: It takes another failure --

6 MS. STEELE: Right.

7 DR. LEVENSON: Failure of the airlock?

8 MS. STEELE: Of the airlock.

9 So their commitment to evaluate the impact
10 of hot gases in the ISA stage along with combustible
11 loading controls gives us a confidence that the
12 finalized design would be acceptable. And so we
13 closed that open item.

14 One open item has to do with the fire
15 barriers. And, of course, you know that this is one
16 of the main PSSCs for all fire events, and it is a
17 PSSC for many other kinds of events.

18 In the draft SER we determined that the
19 margin of safety that was provided for the fire
20 barriers was insufficient. At the facility their
21 barriers are rated a minimum of 2 hours. And I
22 believe there was a question as to why 2 hours.

23 Well, one answer is that, perhaps, our
24 Standard Review Plan also recommends that a minimum of
25 2 hours be provided throughout the facility.

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1 I'm sorry?

2 MR. WESCOTT: Do you want me to answer
3 that one why?

4 MS. STEELE: Oh, okay.

5 MR. WESCOTT: Yes. Well, we borrowed the
6 criteria from a lot of existing DOE criteria. And DOE
7 had picked 2 hours for plutonium facilities for fire
8 area boundary. I guess after looking at the type of
9 fire loads and consequences, and so on.

10 As you recall, Appendix R for reactors
11 required 3 hours. So the problem with the 3 hour
12 barrier is you cannot build it all of noncombustible
13 materials. One of the reasons they had a 3 -- they
14 specified 3 hours because it practically had to be
15 basically reenforced concrete construction or fire
16 doors or something of that nature. And we didn't
17 really think there was a justification for going quite
18 that far unless the fire loads justified it.

19 So basically what we did, we had a
20 minimum, we arrived at a minimum 2 hour barrier. Now,
21 if you have a fire load in there, like let's say you
22 had -- you were storing a diesel fuel day tank or
23 something like that, you might very well want to
24 consider making that a 3 hour or greater barrier.

25 The 2 hours is just a minimum. But we had

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1 picked that based on -- and also I think 801 specified
2 one hour barrier.

3 MS. STEELE: That's true.

4 MR. WESCOTT: So, really, this was kind of
5 in between the ANSI -- or excuse me. The NFPA 801, the
6 NRC Appendix R, and it was pretty much right in line
7 with existing DOE requirements. So it appeared to be
8 a good minimum.

9 CHAIRMAN POWERS: The other issue in that
10 standard is the time temperature curve, which
11 ultimately comes from combustion of a wood frame hotel
12 in 1910.

13 MS. STEELE: Right.

14 CHAIRMAN POWERS: It's applicability to
15 anything else is a mystery to me.

16 MS. STEELE: Right. We have a slide that
17 we can put up. I'm not sure how we -- well, this is
18 not. I'll get to the other.

19 This is somewhat related.

20 CHAIRMAN POWERS: Have to use the
21 microphone.

22 MS. STEELE: Oh, okay. The upper -- well,
23 as you can see, there are three curves there. There
24 you go.

25 Okay. This curve represents the ASTM I

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1 think it's 1929 curve, and that's a more recent
2 development, which applied usually in the
3 petrochemical industry to reflect what an unprotected
4 steel might -- unprotected steel columns might see
5 when there's a hydrocarbon fire.

6 And this lower curve here is the ASME E-
7 119 curve which, as you said, was based on office
8 furnishings from 100 years ago which is not similar in
9 today's environment. And, in fact, what this curve is
10 showing here, this is from a test that was done on
11 some office furniture fires in 1970s. And that
12 exceeds the balance of the ASTM E-119 curve.

13 Now, the next slide that I want to show --
14 Russ, can you put that second one up. Yes.

15 What the applicant that was --

16 DR. LEVENSON: Excuse me. What is that
17 top curve from again?

18 MS. STEELE: ASTM E-1929.

19 DR. LEVENSON: Yes. Yes.

20 MS. STEELE: The one I'm pointing?

21 DR. LEVENSON: Yes.

22 MS. STEELE: That is the one that is used
23 in the petrochemical industry to reflect a hydrocarbon
24 fire.

25 MR. ROSEN: What's the axis? I can't read

1 it.

2 MS. STEELE: Okay. Time in minutes.

3 DR. LEVENSON: 1100 degrees.

4 MS. STEELE: Oh, on the X axis from zero
5 to 60 minutes. And then from zero to 1200 degrees C.

6 MR. ROSEN: So it goes to 1100 degrees C
7 in five minutes?

8 MS. STEELE: That's exactly right. That's
9 the criteria. That's a flash fire.

10 MR. ROSEN: That's C? C degrees?

11 MS. STEELE: Yes. And I might be
12 incorrect about the flotation -- I believe --
13 somewhere in the back of my mind I'm thinking it's
14 ASTM 1729, but I can't read it. So I'm thinking it's
15 1929. I can verify that for you later.

16 This is the ASTM E-119 curve, which is
17 used typically. Yes. Yes.

18 MR. WESCOTT: Once you start getting away
19 from the E-199 curve, you really don't have any basis
20 for comparison. Because, you know, when you talk
21 about a 3 hour wall, normally, or a 2 hour wall or one
22 hour fire barrier, this is all based on the E-119
23 curve at this time.

24 MS. STEELE: There are a lot of criticisms
25 of the ASTM E-119 curve. It's not representative. But

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1 there's also a lot of resistance to change or to try
2 to find another type of standard curve. So this is
3 what we've been stuck with for the last 100 years, and
4 I think probably for another 100 years, unfortunately.

5 MR. ROSEN: It's okay to have a bad
6 century, now and then. It's kind of like what the
7 Cubs did.

8 MS. STEELE: Right. And what is typically
9 done is that you add up all the combustibles that
10 available in a room.

11 And you can put up the other curve, the
12 other graph, please.

13 And use the equal area hypothesis method
14 to relate the fire severity to the fire barrier
15 rating. Now that's another rule of thumb that's
16 commonly practiced, commonly used in the fire
17 protection community and there are criticisms of it.

18 For example, the assumption is that this
19 curve, which reflects -- well, it says here real fire,
20 and this curve which would be the ASTM E-119 curve,
21 that the areas under those curves at a certain
22 baseline would represent similar severity.

23 And I would not argue with that too much
24 if the fire that we were looking -- were interested in
25 was below the standard curve so that, in other words,

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1 it was bounded by that standard curve. But -- yes,
2 temperature.

3 But, for example, one of the measures of
4 the severity is the heat flux to a particular item.
5 And heat flux is based on temperature to the fourth
6 power. So when you start comparing this way,
7 technically you cannot justify -- you cannot defend
8 what's going on.

9 And so we asked DCS to find other methods
10 to analyze the fire barriers.

11 Okay. We can go back to regular.

12 So DCS, the applicant went back and they
13 used FP to -- I think Lary mentioned that -- to
14 demonstrate the duration of the fire. And they were
15 able to show that four most of the fires at the
16 facility that the duration of the fire was less than
17 the fire barrier rating. However, they used a slow
18 growth fire assumption, which is conservative if
19 you're looking at just duration. But I felt that it
20 was nonconservative when you're looking at temperature
21 effects.

22 CHAIRMAN POWERS: Or heat flux effects.

23 MS. STEELE: Heat flux, yes.

24 So for the Construction Authorization, the
25 applicant will evaluate those scenarios that could

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1 exceed the temperature profile in the ASTM E-119
2 curve. They're going to use a rapid group fire
3 assumptions. And where the temperatures do exceed the
4 ASTM E-119 curve, they'll look at whether it could
5 withstand thermal shock. They'll look at, perhaps,
6 some sort of heat flux, heat transfer analysis to make
7 that determination.

8 They've also committed for the integrated
9 safety analysis to look at issues such as flashover,
10 whether that would be credible for any of the
11 scenarios. And, of course, flashover if that occurs
12 there would be accounting for whether the barriers
13 actually fail and could involve more than one fire
14 area.

15 CHAIRMAN POWERS: Will they look at how
16 systems and structures respond to fire suppression
17 activity?

18 MS. STEELE: I don't believe that is part
19 of what they're be looking at to resolve this
20 particular issue. The idea is that fire suppression is
21 defense-in-depth, and although it's not credited in
22 the ISA, it provides an additional layer of
23 protection.

24 CHAIRMAN POWERS: Well, what I'm thinking
25 about is in the integrated safety analysis.

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1 MS. STEELE: Okay.

2 CHAIRMAN POWERS: Because they are going
3 to have suppression.

4 MS. STEELE: Right. They assume -- all of
5 this is assuming that the fire suppression does not
6 work.

7 CHAIRMAN POWERS: And if it does work,
8 does it cause the structure to fail because it's
9 working.

10 MS. STEELE: Yes. You're looking at
11 issues, for example, like the -- well, this would not
12 be water, but this would be clean agent, effective
13 clean agent.

14 MR. WESCOTT: I think overpressurization
15 maybe be --

16 CHAIRMAN POWERS: Actually, the first
17 thing that comes to mind is thermal shock, because
18 thermal shock is much worse in cooling than it is in
19 heating. And a lot of other things. Thermal
20 contraction, destruction of breakage sorts of things.

21 MR. WESCOTT: No, we had not looked at
22 that. But I think for the --

23 CHAIRMAN POWERS: Well, I think it's more
24 appropriate to look at it in the integrated safety
25 analysis.

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1 MS. STEELE: Right.

2 MR. WESCOTT: Right. It's probably much
3 less than you would with a water sprayer sprinkler. I
4 mean, water's going to take a lot more ---

5 CHAIRMAN POWERS: You betcha. You betcha.

6 MR. WESCOTT: -- then -- you know, a
7 gaseous agent like intergen is going to.

8 CHAIRMAN POWERS: But on the other hand,
9 summary is that you fight with water.

10 MR. WESCOTT: You mean like when the fire
11 brigade comes.

12 CHAIRMAN POWERS: Like when the fire
13 brigade comes.

14 MS. STEELE: My understanding was that --
15 well, I see Tim St. Louis out there. But that the fire
16 brigade would respond with additional clean agent
17 suppression in certain areas as well.

18 MR. ST. LOUIS: Yes. Just to go back to
19 the analysis question. We have this part of our ISA,
20 we are looking at both temperature and distribution,
21 or pressure and distribution transients when we
22 discharge clean agent into a room to make sure that
23 there's no structural damage to either the glovebox or
24 the structure.

25 And as far as responding to a fire, we do

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1 have additional clean agent bottles that can be
2 installed and discharged into a room if it's necessary
3 to do that.

4 MS. STEELE: So at any rate, this
5 particular issue remains open until we receive further
6 information in the Construction Authorization stage.

7 MR. WESCOTT: Can I say something real
8 quick to answer a question?

9 One of the requirements the SRP when we do
10 get to the ISA stage is to have fire plans for every
11 area. So if you don't have the fire data, for example,
12 using water in a moderation control area, you know,
13 you plan all those things out beforehand so if the
14 right agent is used for the right fire in the right --

15 CHAIRMAN POWERS: Yes, that's good. I
16 mean, you do have that criticality concern. The
17 opposite concern has arisen so often that we have
18 electrical fires and people are afraid to put water on
19 them, that we let the damn things burn forever.

20 MS. STEELE: Okay. The next open item is
21 out of the soot loading analysis. As you know, as I
22 said before, the process -- the facility's designed so
23 that even during a fire, the process room and glovebox
24 exhaust systems remain operational. And to protect the
25 final HEPA filter, the hot gases are diluted with air

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1 from other area. Spark arresters and pre-filters are
2 provided.

3 In reviewing the calculations in the
4 Construction Authorization Request, we found
5 insufficient justification that the final HEPA filters
6 could perform their safety functions under fire soot
7 conditions.

8 For one, analysis provided for the
9 glovebox exhaust system and the one that was provided
10 for the process room did not appear to have inadequate
11 capacity to remove expected soot loading.

12 CHAIRMAN POWERS: What do you anticipate
13 the blowout loading is?

14 MS. STEELE: The blowout loading?

15 CHAIRMAN POWERS: Upon the HEPA filter?
16 How much can they take before they blow out?

17 MS. STEELE: Yes. Well, Tim Johnson will
18 talk about it some more.

19 MR. JOHNSON: The assumed blowout loading
20 was ten inches of water.

21 MS. STEELE: Right.

22 CHAIRMAN POWERS: That's the blowout
23 pressure drop. What does it take to get to that?

24 MR. ST. LOUIS: Right. What DCS did was
25 they used a method that had been developed in the

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1 literature involving -- they had a sample fire that I
2 think used tributyl phosphate, no dodecane source.
3 That created soot. And they watched the loading on
4 some sample filters over a period of time and they
5 developed a correlation based on that. And that was
6 the basis for their calculation. But what their intent
7 was, was to limit the loading to under 10 inches of
8 water. And by doing that they felt that that would
9 not present such an aggressive loading that it would
10 fail the filter.

11 CHAIRMAN POWERS: Okay.

12 MS. STEELE: Another issue with that
13 correlation was that, that correlation in particular
14 was developed using solvent fires and we didn't feel
15 that it reflected combustibles at the facility.

16 CHAIRMAN POWERS: It's not going to cover
17 polycarbonate fibers, that's for sure.

18 MS. STEELE: Right.

19 The applicant is revising the final
20 filtration analysis. They've provided the information
21 in February and April of this year. We've not
22 incorporated that into the revised draft SER because
23 of the timeliness of the report.

24 And soot loading analysis will be
25 experimentally verified, and we look forward to that.

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1 In conclusion, we do plan to have more
2 technical meetings with the applicant on the open
3 items. And they will be providing additional
4 information to us, which -- in order to address the
5 open item. And we hope to receive that before the
6 final Safety Analysis Report is issued.

7 CHAIRMAN POWERS: Questions of Sharon's
8 presentation?

9 MR. SHACK: Yes, just one question. You
10 mentioned that the separation requirement in the
11 electrical system was entering the building. I
12 couldn't find anywhere the separation requirements
13 within the building for the redundant systems. Do
14 they have a formal requirement, or they just assumed
15 it's in conduit and it's okay.

16 MS. STEELE: It's in conduit. I've seen--
17 I wish the electrical reviewer was here. But I think
18 it's all in the concepts in IEEE 384. Separation
19 requirements there?

20 MR. WESCOTT: There's no mention of a 20
21 foot requirement.

22 MS. STEELE: Right. Right.

23 MR. SHACK: That was sort of what I was
24 looking for.

25 MR. WESCOTT: Right. But it's my

1 understanding that it's probably much more than that--

2 MS. STEELE: More than that.

3 MR. WESCOTT: -- in most places. And
4 since you really got four redundant, you know, feeds.
5 I mean, you might have two of them that are within 20
6 feet, but another couple that are far away.

7 That's something we're certainly look at,
8 because that is, to our knowledge, the only accident
9 where we're concerned about total loss of an active
10 system.

11 MS. STEELE: Okay.

12 CHAIRMAN POWERS: Any other questions?

13 That was very nice.

14 MS. STEELE: Thank you.

15 CHAIRMAN POWERS: That was very nice.

16 Now we're going to give the bosses the
17 chance to give us closing comments. Is that --
18 confinement ventilation. Okay. So we're going to
19 start with confinement ventilation, and it looks like
20 a cast of thousands here before me. Tom St. Louis and
21 Steve Kimura.

22 MR. SHACK: Although shouldn't we be doing
23 fire and the HEPA first?

24 MR. ST. LOUIS: What I'm going to do is,
25 I'm going to start off. Steve and I are going to be

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1 a tag team. I'm going to start off and define or
2 describe the HVAC systems in the facility. And then
3 he will describe the final filter units, the devices
4 we're using to protect them in the event of fire and
5 our analysis of the filter units.

6 Okay. This part of the presentation is
7 for an HVAC system -- description of the HVAC systems
8 in the MOX Fuel Fabrication Facility. What I want to
9 go through in my presentation is the confinement
10 principles, how we've applied them to the facility,
11 what features in the facility we have that implement
12 these principles. A brief summary of the HVAC systems
13 and then just a brief discussion of how the systems
14 would respond to a fire event.

15 MR. ROSEN: I had a confinement principal
16 like that at PS 26. I still remember her.

17 MR. ST. LOUIS: Well, they're both spelled
18 right, they're just wrong.

19 MR. ROSEN: It's spelled correctly, that's
20 true.

21 CHAIRMAN POWERS: As I often point out to
22 my colleagues, I spell very well, not always
23 accurately but very well.

24 MR. ST. LOUIS: What we tried to do at
25 this facility is we've used multiple confinement

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1 barriers, that these confinement barriers perform
2 their function effectively during normal and abnormal
3 conditions, that they confine radioactive materials as
4 close to the point of origin or use as possible. That
5 they present uncontrolled release of these materials.

6 With regard to the multiple confinement
7 zone, we have three confinement zones; a primary,
8 secondary and a tertiary. And we maintain
9 differential pressures between each of these zones.
10 And the HVAC system is capable of running an operating
11 during a facility fire.

12 This slide is just some of the terminology
13 that we will use in our discussion of the C1
14 confinement zone where there's zero potential for
15 contamination. The C2 and PC confinement zones are
16 very low occasional contamination potential, and it's
17 equivalent to Reg Guide 3.12, zone III.

18 The C2 -- well, I'll go into a little bit
19 what's in each of the rooms in the next slide. Next
20 couple of slides.

21 The C3 is low to moderate risk. The
22 material is more easily disburseable. And the C4 is
23 basically the internal of the gloveboxes.

24 Now in applying these confinement
25 principles, we use the walls, gloveboxes, vessels,

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1 cladding as the static separation devices. All the
2 doors are gasketed. Penetrations have seals on them.

3 We use air locks when transitioning
4 between confinement zones, and we have HEPA filters at
5 HVAC openings in the confinement zones.

6 We have a relative pressure gradient with
7 C5 being the most negative, C3 and C2, and then of
8 course the ambient.

9 We permit fully welded enclosures in the
10 C2 and PC zones. And then we utilize two stages of
11 HEPA filters in the final filters prior to discharge
12 from the atmosphere.

13 We also use intermediate filters on the
14 gloveboxes. There's one inside and one outside of
15 each glovebox.

16 When we transition from C3 into the C3
17 rooms, we have a HEPA filter on the inlet and on the
18 outlet. And we have HEPA filters on the intake. And we
19 have two stages of HEPA filters on the exhaust, as I
20 mentioned previously.

21 This slide here is a schematic depiction
22 of what I just described. The outer areas represents
23 the C2 boundary, so the outside of that is the C1 or
24 environment. The inside is the C2 boundary. Instead
25 the C2 boundary is the C3 areas which are process

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1 rooms. Process rooms contain the gloveboxes.

2 Also inside the C2 area is a process cell
3 area which contains all the welded equipment for the
4 aqueous polishing units. As you can see in this
5 diagram, the rods are out in the C2 area.

6 You can see from the illustration also the
7 various filters that we have located in the facility
8 at the boundaries where we transmit from one
9 confinement zone to the next.

10 There's HEPA box -- glovebox filters.
11 There's the filters on the C3, the inlet filter and
12 the dual stages on the final filters before we
13 discharge to the environment.

14 This slide is a depiction of part of our
15 facility showing the different confinement zones. This
16 area is the C2 confinement zone. This area is the C3
17 confinement zone. You can see the air lock here. And
18 this is the process cell confinement zone, which has
19 plugs in the wall. It's really not an accessible area.

20 Now the HVAC systems that we have at the
21 facility consist of the supply air system, which
22 distributes air to all rooms, a medium depression
23 exhaust system which exhausts the C2 zone which
24 consists primarily of electronic units, IO cabinets,
25 control rooms and the corridors.

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1 Process cell exhaust system that exhausts
2 the PC zones where all the process aqueous polishing
3 process equipment is. A high depression exhaust
4 system exhausts the C3 confinement zone, and it
5 exhausts the process rooms that contain the
6 gloveboxes.

7 And finally, the very high
8 depressurization exhaust system exhausts all of the
9 gloveboxes.

10 Now, the next slide is a schematic
11 depiction of how this all fits together. And let me
12 start by saying that the whole facility has 500 some
13 rooms in it, so it becomes difficult to boil this down
14 to a simple little picture.

15 This is the intake assembly, up in the
16 top. And the center part represents the various rooms
17 and spaces in the facility.

18 These areas here represent gloveboxes.
19 These areas, depending on system they are, exhausted
20 on could be C2 or process cell areas.

21 And then around the outside here we have
22 the various final filter units.

23 You will note that we have 100 percent
24 capacity supply fans. We have 100 percent redundant
25 capacity exhaust fans on the MV system. On the C3

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1 system, on the process cell system, but we have four
2 100 percent capacity fans on our glovebox system.

3 As far as filter capacity goes, we have
4 about 110 percent capacity in the C2 exhaust system.
5 We have one spare filter housing.

6 In the C3 exhaust system we have 100
7 percent spare filter capacity. We could take a whole
8 bank out of service, it would still have enough
9 capacity to handle all the exhaust flows.

10 On POE and HDE, we also have a 100 percent
11 spare capacity. We can take the whole filter bank out
12 of service and we'd still be able to handle the
13 exhaust flow.

14 Now, you can see on here our intermediate
15 filter locations. Generally when we transfer between
16 confinement zones with ventilation duct work there's
17 an intermediate filter. The practical aspects of that
18 -- of applying that confinement principle means that
19 we've grouped rooms together into circuits and flow
20 paths to route them into a common intermediate filter.

21 This is just a summary of the air flows.
22 And I put this in here to give you an impression of
23 the magnitude of the HVAC system and the diversity of
24 the system. Our VHD system, which is the gloveboxes,
25 is about 3500 CFM. We have 240 gloveboxes. And our

1 largest glovebox is 117 CFM.

2 And if you go through the rest of these,
3 you will see that we have large systems, a large
4 number of rooms and each room represents a relatively
5 small fraction of the total flow for the exhaust
6 system.

7 DR. LEVENSON: A thousand rooms?

8 MR. ST. LOUIS: Five hundred.

9 MR. SIEBER: It's a big hotel.

10 DR. LEVENSON: Oh, that last one is the
11 supply. Okay. I was adding that to the other.

12 MR. ST. LOUIS: Oh, no.

13 Just briefly to go through the function of
14 each of the HVAC systems. The supply system provides
15 conditioned air for ventilation and environmental
16 control.

17 It also is a principal PSSC in that it
18 provides air for emergency cooling of our storage
19 vaults and some of our PSSCs, for instance, the fan
20 rooms for the fans. It incorporate the necessary
21 controls to distribute and regulate the air. Portions
22 of it are seismically designed, those that are
23 associated with the PSSC. It has tornado dampers in
24 it and it is not an active PSSC. The element that is
25 a principal system structure or component is the duct

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1 work to distribute are for emergency cooling and the
2 HEPA filters on the inlet to the unit.

3 Now the MDE exhaust system, again, is the
4 system that exhausts the C2 area, which is principally
5 the control rooms, corridors, electronic rooms. The
6 system is controlled to maintain a negative pressure
7 differential or maintain the C2 area more negative
8 than the outside.

9 It has filters on the exhaust air prior to
10 discharge. It has tornado dampers on the exhaust
11 system. It is not an active PSSC in that the fans do
12 not have to operate, but the exhaust filters and the
13 exhaust path out of the building and downstream of the
14 filters is seismically designed.

15 CHAIRMAN POWERS: Are the looked at
16 tornado effects on the facilities have tornado sucking
17 out HEPA filters?

18 MR. ST. LOUIS: We are dual tornado
19 dampers, self-closing tornado tampers in the exhaust
20 system and in the supply system.

21 Now, our systems operate fairly at
22 relatively high pressures, at 27 to 50 inches of water
23 is what they'll be designed to operate at at the
24 house.

25 DR. LEVENSON: If the tornado dampers

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1 close, you lose the emergency cooling of the vault
2 feature?

3 MR. ST. LOUIS: Yes, you have no air flow,
4 but it's a short duration and there is a lot of
5 thermal mass there that's not a problem.

6 The process cell exhaust system is pretty
7 much a duplicate of the C2 area. It is not an active
8 system. It does have tornado dampers. It operates at
9 a different pressure in the building. It's more
10 negative than the C2 or the C3 area. So we've set up
11 with a separate exhaust system for that area.

12 The HD exhaust system, this is basically
13 the work horse of the facility. It exhausts all of the
14 process rooms that contain gloveboxes. It maintains
15 those rooms negative relative to the C2 confinement
16 rooms. It provides the motive force to ventilate the
17 PU storage area and selected other equipment rooms.

18 It has intermediate filters at all the
19 boundary areas. And, again, this is an active system.
20 It's on standby power and emergency power. It has
21 tornado dampers. It is seismically designed and it
22 has automatic tornado dampers in it.

23 The VHD exhaust system exhausts air from
24 the C4 zone, which is the interior of the gloveboxes.
25 It maintains the gloveboxes negative relative to the

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1 C3 areas. It has intermediate filters as they show,
2 both one filter inside, one filter on the outside of
3 the glovebox and then another set of filters when we
4 pass from the -- into the C3 to the C2 zones.

5 It is seismically designed. It's on
6 standby emergency and uninterruptable power supplies.
7 It's an active system. It actually can run during a
8 seismic event.

9 It is sized to maintain a 125 feet per
10 minute through either two glove ports or a bag port.
11 Actually, it's a bag port is really the seized -- the
12 opening that sets the size of the -- okay.

13 This is just a brief summary of how the
14 system is designed to operate in the event of a fire
15 in the C3 room. All the supply and exhaust fans
16 remain in operation. There's no trips, no automatic
17 shutdowns. The exhaust dampers remain open. They are
18 manual dampers.

19 Clean agent is discharged into the room to
20 suppress the fire. The fire dampers on the supply
21 side are automatically closed after discharge of the
22 clean agent.

23 The HD exhausts that passes through the
24 intermediate filters can be bypassed in the event that
25 the filters get loaded with soot. That way we're able

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1 to maintain that room at a negative pressure.

2 Products of combustion are cooled by flows
3 from nonprocess rooms. As I noted, there's many
4 circuits. The final HEPA filters, again, are designed
5 to handle soot generated by the design-basis fire.

6 We've looked at the two largest rooms with
7 the highest combustible loading when we're evaluating
8 the operation of the final filters.

9 CHAIRMAN POWERS: Is that the right basis
10 for deciding? Just because I have this large fire,
11 does that mean it has the largest soot loading?

12 MR. ST. LOUIS: We picked the largest
13 combustible load.

14 CHAIRMAN POWERS: Yes, that does not
15 translate into the largest soot loading.

16 MR. ST. LOUIS: Possibly it's correct. We
17 picked two rooms.

18 MR. KIMURA: No. We picked the rooms with
19 the highest soot.

20 MR. ST. LOUIS: Was it with the highest
21 soot? I know when we started, it was just the highest
22 combustible load. And we did do a full yield analysis
23 on each of the rooms.

24 CHAIRMAN POWERS: Okay.

25 MR. ST. LOUIS: Based upon their materials

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1 that are in the room.

2 CHAIRMAN POWERS: Good.

3 MR. SHACK: And the soot load comes from
4 gloveboxes?

5 MR. ST. LOUIS: It's all combustible
6 materials.

7 MR. SHACK: But I mean, is that where you
8 get the highest -- the room with the highest, the one
9 with the gloveboxes?

10 MR. ST. LOUIS: Yes. The C3 rooms have
11 gloveboxes in them.

12 And finally, the C2 confinement zone
13 provides a buffer around all the C3 rooms in the event
14 -- during a fire event.

15 And lastly, the space can be manually
16 isolated from the exhaust if deemed necessary to
17 button up the fire.

18 The glovebox internal fire is somewhat
19 similar, although not on the same scale. All the
20 supply and exhaust fans continue to remain in
21 operation. The glovebox fire detectors sound an alarm.
22 The fire brigade or operator responds with a manual
23 CO₂ unit. But all the other gloveboxes remain to be
24 exhausted and are continued to be exhausted through
25 the VHD system.

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1 There are multiple circuits and multiple
2 gloveboxes so the products of combustion are cooled to
3 below the normal operating temperatures or the maximum
4 operating temperatures of the HEPA filters.

5 And lastly an involved glovebox can be
6 isolated from the exhaust.

7 DR. LEVENSON: Can it also be isolated
8 from the supply system so you don't overpressurize it?

9 MR. ST. LOUIS: Yes.

10 MR. ROSEN: Could you go back to the prior
11 slide just for a minute on a room fire? It just
12 occurs to me that you say that the products of
13 combustion are cooled by the flows from the
14 noninvolved rooms. But isn't there a discharge also
15 from the water fire suppression systems?

16 MR. ST. LOUIS: No.

17 MR. ROSEN: There's no water fire
18 suppression?

19 MR. ST. LOUIS: Not in the C3 rooms.

20 MR. ROSEN: Not in the C3?

21 MR. ST. LOUIS: Water is only -- we have
22 water -- we went into that. But we have water in the
23 corridors and ceratin other parts of our facility
24 where there's no material at risk.

25 In the C3 confinement zone, which is where

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1 the gloveboxes are, we have clean agent. And in all
2 the electronics room, which is in the C2 zones, we
3 have clean agent also.

4 MR. ROSEN: Well, it's been experienced
5 typically, not in these kinds of facilities, but in a
6 lot of facilities that the way you finally extinguish
7 a fire is to cool it off. And the really only way to
8 do that is to get water to it, "put the wet on the
9 red," is what the fire people say. The wet stuff on
10 the red stuff.

11 MR. ST. LOUIS: Yes.

12 MR. ROSEN: And here you've got a
13 philosophy not to do that. And I'm worried about
14 getting the thing cool enough, also it doesn't reflash
15 the minute you bring in outside air or outside air
16 infiltrates. What do you think about that?

17 MR. ST. LOUIS: Well, one of the reasons
18 that we do have the capability to isolate the room
19 completely is to -- and we've done an extensive
20 analysis of the capacity of our fire walls, is to be
21 able to isolate the room and let the fire burn itself
22 off and cool off.

23 MR. ROSEN: By itself without any water?

24 MR. ST. LOUIS: Yes. As part of our fire
25 barrier evaluations that we've conducted, we've looked

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1 at the fire profile in all of the rooms. In fact, we
2 ran the analysis to maximize the duration of the fire.
3 And they all are -- I believe it's 80 percent of the
4 rating.

5 MR. ROSEN: Where would I look for this
6 analysis? If I wanted to check this analysis myself?

7 MR. ST. LOUIS: For the fire barriers?

8 MR. ROSEN: For, say, one of the rooms,
9 the C3 rooms? See what the times involved are. The
10 only cooling mechanism you've got is air flow from
11 noninvolved areas, am I correct?

12 MR. ST. LOUIS: This is not cooling the
13 room. This is cooling the protective final filters.

14 MR. ROSEN: Cooling to protect the final
15 filters?

16 MR. ST. LOUIS: Yes. Not to cool the
17 room. This is -- this cooling flow is to maintain the
18 gas stream that enters the final filters, cool -- cool
19 enough so that it's below their continuous operating
20 temperature.

21 MR. ROSEN: How do you put the fire out?

22 MR. ST. LOUIS: With the clean agent.

23 MR. ROSEN: It doesn't have any heat -- it
24 doesn't absorb any heat. It smothers the fire.

25 MR. ST. LOUIS: Yes, it removes the

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1 oxygen.

2 MR. ROSEN: Removes the oxygen.

3 CHAIRMAN POWERS: As soon as you stop the
4 flow.

5 MR. ROSEN: As soon as you take that stuff
6 off, guess what happens? The stuff is -- it's still
7 as hot as it ever was.

8 MR. ST. LOUIS: But we've removed the air
9 supply, the fire damper on the supply side is closed.

10 MR. ROSEN: Yes.

11 MR. ST. LOUIS: So there's no oxygen for
12 the fire.

13 MR. ROSEN: Understand. And that goes on
14 for one minute, one hour, one day. And then someday
15 you have to put air back in this room and the stuff is
16 still at 1500 degrees C. It's never cooled off. Well,
17 maybe a little conduction.

18 I'm trying to figure out -- how do you
19 ever get the fire out? I mean, you have -- well, the
20 fire's out. The minute you put air back in there, it
21 starts again, doesn't it?

22 CHAIRMAN POWERS: Yes, we've seen these
23 things happen where they've stood around for an hour,
24 and then opened up a cabinet fire and boom.

25 MR. ROSEN: I saw a very interesting film

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1 of this by the British Fire Safety group, and I think
2 I reported that to the ACRS last year. Exactly this
3 phenomenon, a test of a cable tray fire in a room
4 where the fire was clearly out. They had video of it.
5 It was clearly out. But the minute you turn the fans
6 back on, you have a full conflagration again. Because
7 there's no heat removal. You have to remove the heat
8 somehow, otherwise it flashes right away. So I don't
9 understand.

10 I mean, I understand it up to a point. I
11 don't understand how you get down from this peak that
12 you've got yourself up on.

13 MR. ST. LOUIS: The temperature in the
14 room.

15 MR. ROSEN: And in whatever is in the room
16 that burned, very hot. Clearly it has no oxygen so it
17 can't burn anymore, but it's still very hot. Don't
18 you get it?

19 MR. ST. LOUIS: Well, yes. I mean, we have
20 the capability to isolate the room and let it cool
21 off. Now -- and we can maintain a negative pressure on
22 it so that it draws air in through any leaks or
23 cracks. And it can be just cooled off.

24 Now, we have extra gas capacity to put in
25 the room, clean agent. But with these rooms that have

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1 material at risk, our design philosophy is not to put
2 water on them, although we do have water in the
3 building. We have a stand pipe and a hose system.

4 CHAIRMAN POWERS: I think what he's
5 worried is that you're going to have maintain inerting
6 on this thing for a very long time. You may not have
7 the capacity -- I mean, I don't know what capacity you
8 have to have if you have something akin to a cable
9 tray fire.

10 MR. ROSEN: I'd like to see an analysis of
11 this that's carried for -- for as long as it needs to
12 be carried out that ultimately gets you to conditions
13 where you can stop feeding it clean agent. Because
14 it's now got cool enough that you can restore air to
15 it without having a flash. How long does that take?

16 MR. KAPLAN: This is Gary Kaplan.

17 Maybe I can -- are you asking from just a
18 purely fire perspective or a nuclear safety to meet 10
19 CFR 61? Because there's really two different answers.

20 MR. ROSEN: Well, give me both answers.
21 I don't know what I'm asking.

22 MR. KAPLAN: Okay.

23 MR. ROSEN: I'm just asking a physical
24 question.

25 MR. KAPLAN: All right. To meet 10 CFR 61

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1 we're worried about the dose criteria. And so for
2 these glovebox or room fire, we've assumed basically
3 all the MAR in that room is involved in the fire
4 regardless of how long it takes. And we're -- and
5 what we're designing to is to keep the fire in that
6 one fire area. And the Fire Hazards Analysis does
7 that regardless of how long the fire burns. So if
8 it's a 2 hour fire or a 3 hour, it burns all the
9 combustibles. So whether you put it out and let it
10 come back on again, you've accounted for that.

11 So our design is to insure the HEPA
12 filters work and can mitigate the plutonium that
13 you've released. And that's how you meet 10 CFR 70.61
14 criteria for those fires.

15 MR. ROSEN: Okay. So that's for off-site,
16 those protections.

17 MR. KAPLAN: Right. Now for the person in
18 the room we basically say he leaves the room or he
19 comes back in with protection.

20 MR. ROSEN: Yes.

21 MR. KAPLAN: So to meet the criteria we
22 have a strategy that works, and that's why we're
23 talking about cooling, making sure the final filters
24 are cool.

25 Now your question from a fire safety

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1 perspective, how do I know this doesn't take 20 hours
2 of on and off and on and off, that's -- you know, we
3 would leave it alone from a nuclear safety perspective
4 and not do anything, and we'd be okay.

5 MR. ROSEN: I agree with that. I think
6 from a nuclear safety perspective --

7 MR. KAPLAN: Right.

8 MR. ROSEN: -- your design is sound.

9 MR. KAPLAN: Right.

10 MR. ROSEN: From a personnel safety
11 perspective it's sound, because nobody has to be in
12 there. They get out.

13 MR. KAPLAN: That's correct. What are
14 they really going to do?

15 MR. ROSEN: No, they're going to do just
16 what you say.

17 MR. KAPLAN: Right.

18 MR. ROSEN: And then at some point
19 somebody's going to want to terminate the event. And
20 the question is when and do you have enough clean
21 agent to keep it cool for as long as it needs to be
22 kept cool. You've got an adiabatic situation almost.
23 There's no way of getting any heat of the room. You've
24 got it bottled up.

25 MR. KAPLAN: No. The HDE is still running

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1 and pulling. I mean --

2 MR. SIEBER: Well, if you're still dumping
3 clean agent in there, that presumes you isolated that
4 area. Otherwise you'd just sweep the clean agent out.

5 MR. ROSEN: Well, I don't want to solve it
6 here.

7 MR. KAPLAN: Right.

8 MR. ROSEN: But I do want an answer
9 someday to what is the fire shutdown strategy for this
10 room. I mean, take one of the seriously big rooms with
11 a lot of combustible loading and track through them
12 beginning to end.

13 MR. KAPLAN: Right.

14 MR. ROSEN: There's quite a bit of
15 experience. It says this is a real hazard. And it's
16 not just having a reflash. It's worse than that.
17 Because what you do is you bake off all of the
18 combustible vapors in the room so that when you put
19 oxygen back in the room, it doesn't just burn. It
20 detonates.

21 MR. KAPLAN: Lary, do you haver a
22 response. Okay.

23 MR. ST. LOUIS: We have, and this is along
24 the line that you're inquiring, we have committed to
25 do an analysis of flashing of hot gases in the exhaust

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1 systems when the gases from the room combine with the
2 other flows to evaluate that.

3 MR. ROSEN: And that's an analogous
4 question.

5 MR. ST. LOUIS: Yes. And we have not done
6 that analysis yet, but we have committed to do that.

7 This is just a little schematic of all the
8 devices that are available to assist in the operation
9 of the ventilation system.

10 We have -- here's our inlet fire closure
11 devices. Some of them are fire dampers or fire rated
12 valves on the inlet side. On the exhaust side it's a
13 manual fire rated valve. Because on the VHD it's small
14 capacity. We're actually using a thin wall piping.
15 And this here is a fire rated damper that we can close
16 manually.

17 And here you can see the bypasser on the
18 HEPA filters.

19 This illustrates the flows from the other
20 rooms and so on coming into the exhaust system prior
21 to entering the final filters.

22 In closing, I just wanted to say that the
23 systems are designed to mitigate the release and
24 dispersion of materials. They remain functional
25 during abnormal system events. They include a very

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1 highly efficient filtration system. They operate
2 during normal events and they meet the intent of Reg
3 Guide 312.

4 CHAIRMAN POWERS: Have you selected your
5 HEPA filters yet?

6 MR. ST. LOUIS: Yes, we have a basic
7 specification.

8 CHAIRMAN POWERS: Paper? Are they paper
9 filters?

10 MR. ST. LOUIS: No. Glass media,
11 stainless steel housing.

12 I'm taking Steve's thunder away. He's
13 going to go through all of that.

14 Thank you.

15 MR. KIMURA: All right. My name is Steve
16 Kimura. And I'm here to highlight the key features in
17 the MFFF HEPA filter system design to show how the
18 MFFF intends to protect HEPA filter media from damage
19 resulting from severe accident conditions, such as a
20 fire.

21 The features that I will present have been
22 taken from many previous facility designs where they
23 served different roles unique to each facility in
24 which they were used. We have assembled these
25 features to work together to protect the HEPA filter

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1 media from severe environment stress.

2 The design that I'm going to present may
3 seem a bit new to most of the members of the panel,
4 but the features are fundamentally sound. And we've
5 had reviews by industry experts to that effect.

6 I'll also present some basic information--

7 CHAIRMAN POWERS: When you say reviews by
8 industry experts, the industry for running MOX
9 facilities is a bit thin. What do you mean by
10 industry experts?

11 MR. KIMURA: We have Warner Bergman here
12 who has conducted over 30 years of experiments on HEPA
13 filter and has designed various HEPA filter systems.

14 CHAIRMAN POWERS: So it is the expertise
15 in HEPA filters and not MOX facilities?

16 MR. KIMURA: Right. Right.

17 CHAIRMAN POWERS: Okay.

18 MR. KIMURA: And I'll present some basic
19 information about the HEPA filters, just to make sure
20 that everyone has a firm foundation in which to base
21 questions about the effects or the impacts that could
22 damage or impair the HEPA filter efficiency.

23 HEPA filters are really particulate
24 removal systems. The term HEPA is short for high
25 efficiency particulate air filter. The U.S. Army, in

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1 fact in World War I, needed to find an effective means
2 to filter out material from the air. And the HEPA
3 filter was the result of some of that research.

4 In World War II the HEPA filter was found
5 to be the most effective means to remove radioactive
6 materials out of the air, because of the same particle
7 sizes. And that formed the basis of why we use HEPA
8 filters today.

9 The general term HEPA filter actually
10 refers to a complete assembly of components which
11 includes at least one stage of the HEPA filter media.
12 The other components of the assembly are designed to
13 protect the HEPA filter media from clogging and/or
14 damaging from internal and external sources.

15 The HEPA filter media is bolted into an
16 accordion shape to maximize the surface area and is
17 installed into the standard size subassembly, called
18 a HEPA filter element.

19 The HEPA filter media itself is now made
20 of entirely noncombustible material, including the
21 sealants that hold it in place. So they're glass fiber
22 or they can be stainless steel glass fiber mix. and
23 I'll explain how we use those different filtering
24 elements in our design.

25 The HEPA filter media is designed to

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1 filter greater than 99.9 percent of the most
2 penetrating particle size, which is approximately .15
3 microns in size.

4 The small particles will enter the filter
5 media and get ensnared in the fibers. Particles that
6 are either smaller or larger than that size will tend
7 to unity as a capture ratio.

8 Because the HEPA filter media mesh is so
9 fine, larger particles will tend to collect on the
10 surface and, therefore, have a higher tendency to clog
11 the filter and block the airflow. So that's one of
12 the things that we need to prevent.

13 In order to keep large particulates from
14 blocking the HEPA filter media, less efficient
15 roughing filters are used. These pre-filter elements
16 increase the life and allow the HEPA filter media to
17 effectively filter the smaller particles for a longer
18 time.

19 Soot is very small. It's on the order of
20 the most penetrating particle size, about 21.2
21 microns.

22 Go back. I just want to cover a couple of
23 more points.

24 CHAIRMAN POWERS: That's not my image of
25 soot. My image of soot is --

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1 MR. KIMURA: There are --

2 CHAIRMAN POWERS: Long chain of glomerates
3 produced -- I mean, the soot formation is an ionic
4 mechanism so that it gets long chain, high collision
5 shaped factor particles.

6 MR. KIMURA: That is true. But tests have
7 been done to show that soot will pass through what you
8 would expect would be -- an 80 percent efficient
9 filter, would collect something of that nature. But
10 soot has been shown to pass through that type of
11 media.

12 The geometric mean tends to be smaller,
13 more on the order of what a HEPA filter would collect.
14 So the efficiency in order to collect that has to be
15 a little bit higher.

16 HEPA filters are built to standards and
17 are extensively tested both by the manufacturers. And
18 once they're installed to insure that they effectively
19 filter. We're trying to filter out very small
20 particles at a very efficient rate. Small leaks,
21 pinholes, cracks, things like that can seriously
22 degrade the HEPA filter efficiency.

23 It has been stated in previous -- in the
24 literature, that HEPA filter efficiency is degraded as
25 you go from the first stage to the second stage, and

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1 so on. That's not true. The HEPA filter efficiency
2 is the same across each stage.

3 MR. ROSEN: The two filters?

4 MR. KIMURA: Two filters in series.

5 MR. ROSEN: If you did three, would we get
6 nine nines or eight nines.

7 MR. KIMURA: You get three, you'd get nine
8 nines or six nines, depending on how much you take for
9 the first stage.

10 DR. BERGMAN: Warner Bergman, consultant
11 for these.

12 For many years, and even now, many people
13 think the second and third stage is less efficient.
14 And this is primarily due to inefficiencies in
15 artifacts in the measurements.

16 I '74, '75 time era, Harry Ettinger,
17 Gonzales, a group at Los Alamos tried to really define
18 this point. And they had the highest concentration of
19 radioactivity that they could aerosolize through three
20 sets of filters. And they demonstrated that even if
21 you take very heroic measures to remove the background
22 from the third stage filter, you could still measure
23 it.

24 They would wait one week before they would
25 count, let the natural decays decay on the background

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1 radiation for a week. And even with all these
2 measurements, some studies, and we finally summarized
3 in support with this overall program here, showing
4 that even under these heroic measurements they still
5 suffered from some background measurements on the
6 third stage. The first two stages were unequivocally
7 the same efficiencies. The third one started because
8 they couldn't have enough challenge, the background
9 now came up to a higher level.

10 And so there's many causes for background
11 radiation and measurements, and people ascribe all
12 kinds of properties then to filters because of these
13 artifacts. And the point is that if you conduct an
14 experiment properly or you measure properly, the
15 third, fourth and fifth stage HEPA filter will have
16 the same efficiency as the first one. And that's
17 substantiated by theory and experiments that can go as
18 far as you can go.

19 Thank you.

20 MR. KIMURA: All right. This is a
21 schematic view of the final HEPA filter unit that
22 we're going to be using at the MFFF. It consists of
23 several components.

24 Number one is a structurally strong
25 stainless steel housing that contains all the elements

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1 and make sure that outside influences don't damage the
2 filter media inside.

3 The first element here, number two, is
4 somewhat different than what most people are used to
5 when they see a HEPA filter. This is a structurally
6 strong roughly filter made with a stainless steel wire
7 mesh filter media contained in expanded metal cage.
8 This filter can be fully plugged up to the
9 differential pressure created by the exhaust fan
10 without collapse. You don't see that in pre-filter
11 media in other sites.

12 The second one, as I said before, is a
13 structure strong high efficiency prefilter that's
14 designed to collect the soot. What we anticipate is
15 that 90 percent of the soot is still going to pass
16 through the first prefilter, the roughing filter.
17 This filter here is designed to collect the great
18 majority of the soot that's generated in exhaust gas
19 stream.

20 It's made of a stainless steel wire mesh
21 with glass fibers. And, again, this reinforced with
22 the expanded metal wire cage so that if it gets all
23 plugged up, it can withstand the full differential
24 pressure that the fans can pull without collapse.

25 Number four filter is more traditional

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1 prefilter media that you would see, glass fiber, that
2 we have in here as an option right now. And it's
3 under evaluation whether this is going to remain.

4 The final protection elements, the one
5 that keeps all plutonium out the stack is going to be
6 these two elements here. These are the HEPA filters
7 themselves.

8 CHAIRMAN POWERS: What's the bypass flow?
9 When you install this device, there's going to be some
10 flow bypassing either internally or externally through
11 the device?

12 MR. KIMURA: Internally they've been
13 tested to 99.95 percent in situ VOP. That has been
14 shown to guarantee that this will be greater than 99.9
15 percent efficient for the .15 micron particles. That
16 efficiency is guaranteed at the factory, tested at the
17 factory and then once we install and upon replacement
18 will be tested.

19 So it's tested upon initial installation.
20 There is a periodic test and then tested upon
21 replacement.

22 DR. KRESS: How do you test for the bypass
23 flow?

24 MR. KIMURA: The aerosol is injected
25 upstream of the filter media and then measured

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1 downstream.

2 DR. KRESS: Just checking the efficiency?

3 MR. KIMURA: Yes. Right, overall
4 efficiency. If you collect too much downstream, then
5 you know you got a problem.

6 DR. KRESS: Right.

7 CHAIRMAN POWERS: Do you have to worry
8 about knock-through?

9 MR. KIMURA: Are you worried about the
10 knock-along effect or --

11 CHAIRMAN POWERS: Yes.

12 MR. KIMURA: -- alpha recoil?

13 CHAIRMAN POWERS: Yes. It's not through
14 unfilters, knock-along in ducts.

15 MR. KIMURA: Can we go to the backup
16 slides. Slide 16.

17 We conducted a review of the literature on
18 the subject going back over about 30 years. In fact,
19 it was 29 years to 1974.

20 We have concluded that the knock-along
21 effect is inconsequential in regards to the total
22 amount of material that could pass through two stages
23 of HEPA media. As stated by Gonzales, Elder and
24 Ettinger, the measure of HEPA filter efficiencies
25 remain well within present minimum AEC performance

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1 guidelines for each stage. And they quote some
2 numbers here.

3 And they said that the second stage HEPA
4 filter efficiency exceeds 99.99 percent.

5 Since that time, this was back in '76,
6 since that time no direct statistical -- significant
7 evidence has been presented that contradicts the basic
8 conclusion reached by Gonzales, et.al. that the
9 protection factor of the two stages of HEPA filters
10 can be shown to be greater than 10 to the 9.

11 Next, 17.

12 This is a fairly busy slide. It presents
13 probably what everyone would consider the -- I guess
14 the father of knock-along effect in HEPA filters.

15 Niels Hetland and John Russell in 1974
16 were doing a survey of Rocky Flats plants various
17 filter. At Rocky Flats Building 771 they have about
18 39 grams on average of plutonium on every one of their
19 HEPA filter elements.

20 They used a drum counter, which picks off
21 the activity from the entire 39 grams, and measures it
22 to an accuracy of plus or minus 2 grams.

23 In the second stage filter they tried to
24 use the same drum counter and measure 390 micrograms
25 of plutonium. And on the third stage 3 micrograms. And

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1 on the fourth stage 0.5 micrograms.

2 What Dr. Bergman had stated was that when
3 you do that, these two filters get dominated by the
4 background effects. It gets very hard to increase the
5 counting time long enough for you to get an efficient
6 measurement. You would actually probably have to count
7 for several years in order to get sufficient accuracy
8 in those counts.

9 CHAIRMAN POWERS: It's background
10 dominating, you can count until the end of time it
11 won't help you.

12 MR. KIMURA: Right. Just to get an
13 accurate count on the source itself.

14 CHAIRMAN POWERS: It just won't do you any
15 good.

16 MR. KIMURA: I have several more slides
17 that just show the history of the effects. I don't
18 know if we want to --

19 CHAIRMAN POWERS: Well, we know the
20 history of the effect. We know that -- I mean, there's
21 this great Los Alamos film of showing it actually
22 happening. I mean, the particles do move because of
23 the recoil effect.

24 I mean, Ettinger's a great guy. Why he is
25 so confident this thing's not going to work? I mean--

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1 DR. BERGMAN: Warner Bergman again from
2 DCS.

3 If I could just add to both this knock-
4 along and a very closely related thing of what's
5 called alpha creep.

6 Both of these phenomena kind of get bashed
7 around without a lot of real detail scrutiny to the
8 point where, like for example, at Livermore half the
9 scientists that actually have working experience with
10 actinides swear by it, the other half say it's a
11 wives' tale.

12 And so, for example, the alpha creep has
13 only recently been elucidated with funding from
14 Stockpile Stewardship, of which they wanted to know
15 very precisely what happens over long times with
16 plutonium and alpha materials. And papers published
17 within the last two years show that even room air, if
18 you expose a slab of plutonium, or small -- even
19 plutonium metal, very tiny particles are omitted. And
20 even the act of opening up a can or opening up a
21 glovebox door creates sufficient turbulence to release
22 some of these. And so if you come with a measurement
23 instrument, then you find it dispersed throughout the
24 glove.

25 So this is ongoing research. Only two

1 papers have been published so far, but the idea is
2 that the thing of popping off ideas is not valid for
3 that particular thing. However, another class of
4 research being done in basic nuclear physics, again
5 primarily supported by Stockpile Stewardship, of which
6 both experimental and theoretical computations that
7 are related to alpha omissions. They're not studying
8 alpha omissions per se, the recoil and then the
9 subsequent chunks popping off. What they are studying
10 is things like spattering the -- where they bombard
11 pieces of metal with high energy ions and other
12 materials. And these, they create external
13 excitations, very similar to what happens with alpha
14 recoil in principle. And they have found the initial
15 studies that McDowell and some of the people many
16 years ago, what they speculated was in fact verified
17 experimentally. And the current, both experimental and
18 theoretical simulation studies, show that the number
19 of particles decrease. You can find 500 popping off
20 parts, up to 500 atoms, they speculate even a 1,000
21 atoms. The problem is the probability of each one of
22 these events is one over the number of atoms squared.

23 So it doesn't take very long before you
24 have ten to the minus ten probability. So even though
25 the phenomena that was speculated 20, 30 years ago is

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1 valid, there's no question about that, both
2 theoretical and experimental, the actuality of it it's
3 inconsequential. It's such a small event.

4 So the unfortunate thing, much of the
5 research hasn't been put into the literature that it's
6 available to everyone at present. And we're trying to
7 correct that situation and maybe publish something in
8 Nuclear Safety, or something of that nature.

9 So, thank you.

10 CHAIRMAN POWERS: Nuclear Safety is no
11 longer an extant journal.

12 MR. KIMURA: I just want to make one
13 concluding remark on that. During the '70s, the late
14 '70s through the '80s a lot of speculation occurred as
15 to whether the ultra-fine particles that you would get
16 from this alpha particle decay would pass through HEPA
17 filter media. Between those ten years, 1988 and 1998,
18 there is a large number of investigators that looked
19 at the retrainment principles and what happens with
20 ultra-fine particles and they found the classical
21 filtration theory that these small particles tend to
22 go to zero penetration or unity on efficiency.

23 Have to go back.

24 Any other questions?

25 Okay. Next slide. I think we covered

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1 everything on this one.

2 When Tom went through and talked about
3 intermediate filters on the room air, this is just a
4 picture of that.

5 Next one.

6 This is actually a picture of the roughing
7 filter, a full sized prototype.

8 Under typical installation you would see
9 a spark arrester with just this expanded metal cage,
10 and they call that a spark arrester. What we have
11 done is we have gotten this with the expanded metal on
12 both sides and some re-enforcing bars. But inside is
13 stainless steel wool, so to speak. It's stuffed into
14 here to form the roughing filter. And that's going to
15 be collecting the filter media.

16 Okay. My next slide is just a half sized
17 prototype of the high efficiency prefilter with the
18 re-enforcing bars in this fiberglass wool with
19 stainless steel fibers intermixed into it, inside of
20 a stainless steel box.

21 This filter is designed to be 99 percent
22 efficient for particles greater than 2 micrograms in
23 size and greater than 90 percent efficient for
24 particles less than 1 micron in size, which is soot.

25 Okay. Next.

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1 This is a picture of the HEPA filter
2 element. In the past the frames have been made with
3 wood and with stock wood. This is actually more fire
4 resistant than steel in some cases because of the
5 warping capability. But the way this is constructed,
6 the steel is a stronger -- structurally stronger
7 design.

8 Filters are designed to withstand 400
9 degree fahrenheit continuous service. And our test did
10 up to 5 minutes at 700 to 750 degrees, so they can
11 still be efficient at even extreme high temperatures.
12 There's a screen on the front and back that helps
13 protect against blowout, but otherwise the filter
14 media itself is noncombustible.

15 CHAIRMAN POWERS: What is it?

16 MR. KIMURA: Glass fiber.

17 And it's tested to be 99.97 percent for .3
18 micron size particles, and that corresponds to the
19 99.9 percent at the .1 fine micron most penetrating
20 particle size.

21 This lip here will actually be filled with
22 a sealant material, and that goes into a knife edge
23 and then forms a robust seal for the filter. And
24 that's part of the anti-bypass design.

25 The testing, the manufactured tested

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1 design for the efficiency pressure drop rough
2 handling. They shake it three quarter inch vibration
3 table. Pressure, moisture, heated air, pinhole leaks
4 and spot flame resistance. They put a blow torch to it
5 and make sure it doesn't burn through.

6 Before any filter leaves the manufacturer,
7 they test it for final efficiency before shipment.

8 Once it gets to our site and gets
9 installed into the filter housing, we do in situ tests
10 to insure that the filters were not damaged during
11 shipment and that they've been installed properly.

12 And the test, it will insure that we met
13 our efficiency requirement, that they structurally
14 withstand greater than ten inches of delta T across
15 them and with 700 degrees for up to 5 minutes.

16 CHAIRMAN POWERS: This in situ testing
17 that you do, once you've installed it, that's under
18 your Appendix B program?

19 MR. ST. LOUIS: Yes.

20 CHAIRMAN POWERS: Because I have seen
21 installations that had all of this, that you could
22 have borrowed their slide. And the problem is people
23 get tired of doing this and so they slope them
24 together, write down, yes, tested it. And you find
25 out you can put your finger in the gaps that they

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1 leave.

2 MR. ROSEN: Not in the nuclear industry,
3 of course.

4 CHAIRMAN POWERS: Not in the U.S.
5 commercial nuclear industry, and definitely not in
6 South Texas.

7 DR. KRESS: You test every one of the
8 filters, of those last three items or you sample them?

9 MR. ST. LOUIS: No. All the HEPA filter
10 are individually tested. And the --

11 DR. KRESS: You subject them to ten inches
12 of H₂O pressure --

13 MR. KIMURA: No. This is a sample. Ten
14 inches is a sample.

15 The efficiency, everyone is tests for
16 efficiency.

17 DR. KRESS: But you sample?

18 MR. KIMURA: But we sample for the ones
19 that could physically damage them, because --

20 DR. LEVENSON: The problem is those lost
21 two things don't apply to the bullet above it.

22 DR. KRESS: Yes.

23 DR. LEVENSON: I mean, the bullet above is
24 installed and this is an insert. It sort of reads
25 like you're testing the installed ones at 700 degrees.

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1 And I don't think so.

2 DR. KRESS: That's what caught my
3 attention.

4 MR. KIMURA: All right. I think we've
5 covered everything we need to cover on this slide.

6 HEPA filters have been studied for a long
7 time. The effects of what they do and how they work,
8 and what causes them to break are pretty much known.
9 There are short term physical effects. Essentially
10 the big categories are they leak, they can clog and
11 they can burst. And what causes that are embers,
12 smoke, soot, high temperature, moisture, water, air
13 flow.

14 There are long term effects that are
15 lumped together under the category called aging. And
16 these may have to do with chemical exposure, exposure
17 to moisture or water and radiation damage. Other
18 factors could be, you know, you get a bad filter,
19 manufacturing defects. You can install it wrong. You
20 can damage during installation.

21 Inspection errors. You don't inspect or
22 the inspector misses something.

23 DR. LEVENSON: While the concept has been
24 around for 50 years, the particular media you're using
25 I don't think is quite that old. How old is -- how

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1 much experience is there with the actual media you're
2 using? Media in the HEPA filter itself?

3 MR. KIMURA: The media we've been using is
4 pretty much been in service since the early '60s.

5 In 1969, which is the Rocky Flats fire,
6 they had noncombustible HEPA filter media. The
7 previous fire in 1950 was paper, and paper was easily
8 ignited.

9 DR. LEVENSON: Was the '69 the same media
10 you're using? I mean --

11 MR. KIMURA: No.

12 DR. LEVENSON: How long -- what's the
13 history on the actual media you're using?

14 DR. BERGMAN: This is Bergman.

15 The media changes every year. The media
16 that existed back in the -- Arthur Doolittle, when
17 they first did the work with the Army to develop the
18 first HEPA filter and then with Cambridge. Cambridge
19 formed as a consortium for them. That started out with
20 asbestos and paper fibers. Then Wendell Anderson and
21 others helped develop with glass. And every year they
22 learned improvements making glass smaller and smaller,
23 different formulations, thicknesses. So each -- there
24 is a development across time, and I'm sure the filter
25 we have tend to be different than what we have now.

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1 The trends are smaller fiber diameters
2 within economic trend and higher strengths. So
3 formulation change to improve the efficiency, reduce
4 the pressure and increase the strength. So those are
5 the changes that evolve over time.

6 DR. LEVENSON: Yes. And those three can be
7 tested, but the question of the aging you can't go
8 back and say there's X years of experience, but your
9 media is only a couple of years old.

10 DR. BERGMAN: You're absolutely right. And
11 we had -- that precise point was a great consternation
12 to a problem we had for establishing age limits on
13 HEPA filters. We were comparing apples and oranges and
14 we wondered why there were a couple of papers that
15 were presented. I mean, we're talking about an order
16 of magnitude of variation of data. And it's like a
17 moving target. We were comparing filters 20 years ago
18 with the present time, and in some cases some
19 manufacturers had better media 20 years ago than some
20 today, you know, But this was the variability.

21 So, it's a very complex issue. And so the
22 latest trend as far as aging is concerned is to use
23 them -- we've used and written a paper using the most
24 conservative numbers and it's in coincidence with Mel
25 First and some of his studies and helped establish age

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1 limits for HEPA filters precisely to address some
2 issues like that.

3 DR. RYAN: You mean age in service or age
4 on the shelf, or both?

5 DR. BERGMAN: Both. A filter will degrade
6 even if it's sitting on the shelf for 5 years.

7 DR. RYAN: What is that age limit now?

8 DR. BERGMAN: Right now based on all of
9 the available data we've had with -- which Jon
10 Fretthold generated at Rocky Flats, for what we call
11 a very dry situation, we say 5 years. And for -- I
12 mean, for a situation where you can have moisture
13 exposure, because filters like most tissue will get
14 soft and that with water. So 5 years for a wet
15 application, ten years for an application that's dry.
16 And by dry, I don't mean the last incipient fire, but
17 where you have like a water spray and other potentials
18 to really wet things down.

19 MR. KIMURA: All right. The MFFF design
20 in addressing the factors that impact the HEPA filter
21 media, on embers, and as I stated, we have the high
22 strength roughing filter, it collects the embers,
23 collects the hot particles, the brands. It can burn
24 holes through the more delicate HEPA filter media.

25 Soot, again, if soot collected on the face

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1 of the HEPA filter, the delta p's can go up very high,
2 greater than 10 inches and eventually causing
3 bursting. To prevent that, we mitigate it by use of
4 the high efficiency prefilter. And those filters
5 collect the soot, withstand the delta p's. Only a
6 small amount of soot gets onto the final HEPA filters
7 so the delta p across the final HEPA filter stays very
8 low.

9 High temperatures. We mitigate that just
10 by the design of the filter media itself and the
11 filter element so that they're noncombustible.

12 The sealing is noncombustible that we use.
13 In the past, urethanes that actually burned have been
14 used and other materials that you wouldn't think,
15 while the entire HEPA filter itself is said to be
16 noncombustible, the wood frame if you get it hot
17 enough will burn.

18 The other factor that we have is dilution
19 air flow. As Tom said, there is a lot of other
20 noninvolved areas once we have a fire. So all these
21 other flow areas act to dilute and cool down the
22 flowstreams.

23 High moisture. Again, when you have a
24 fire, fire generates a lot of moisture just in the act
25 of combustion. That's mitigated by dilution air flow,

1 that lowers the relative humidity of the gas stream.

2 DR. LEVENSON: Dilution air flow protects
3 only your final HEPA filters. It does not protect the
4 regional ones, right?

5 MR. KIMURA: Right. And what we're doing
6 here on the final HEPA filters is protecting the
7 public. We're keeping the material from leaving the
8 stack or entering the stack.

9 Entrained water. In 1980, Rocky Flats
10 fire entrained water from the water strays sprayed
11 directly on the HEPA filters was implicated in causing
12 them to be blown out and causing more damage than the
13 fire that occurred on the HEPA filter media itself.

14 As a result, that's why we depict dilution
15 air flow over water sprays to mitigate that, or
16 prevent that happening.

17 DR. LEVENSON: You don't really mean
18 you're dilution air goes over water sprays? You mean
19 instead of?

20 MR. KIMURA: Instead of. In lieu of.

21 Okay. High delta P across the HEPA filter
22 media is caused by how many things there are to burn,
23 how much soot you generate that's going to clog the
24 filter, that's going to cause the high delta p.

25 We have combusting loading controls in all

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1 the fire areas, and then all the filter elements, not
2 just the high-strength prefilter elements, have
3 defense-in-depth monitoring for differential pressures
4 so we can monitor during normal operations, change out
5 the elements to make sure they're clean before an
6 event happens.

7 Aging, as we said, can occur because of
8 chemical exposure. There are two sets of filters being
9 used. For the HVAC system, there are no chemicals
10 that the filters are exposed to on a routine basis.
11 The process ventilation fumes where you get most of
12 the chemicals are exhausted off of separate flow
13 screen, which is a very small airflow, 2 -- 300 CFM.
14 That gas gets treated before being released. So that
15 the big filters, the ones that do the ventilation air,
16 have no chemicals.

17 Radiation exposure. Unlike other
18 facilities we have many, many filters upstream of our
19 final HEPA filter elements. We don't expect to have
20 the high radioactive material load on the final HEPA
21 filters that causes problems. There's some periodic
22 inspection and maintenance to these that go along to
23 insure there is no build up.

24 Moisture. The moisture has been indicated
25 in reducing HEPA filter media strength after a short

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1 exposure and redrying. You can seriously degrade the
2 strength of the HEPA filter media. So exposure to
3 moisture is part of our facility's design features to
4 keep the relative humidities under control in the
5 areas where water can get into the air.

6 In order to insure that these severe
7 conditions don't impact the HEPA filters, we've done
8 a series of analyses and plan to do a series of
9 analyses for those that aren't complete yet. We have
10 a Fire Hazard Analysis, which looks at the total fire
11 loads.

12 Fire severity modeling, which does a more
13 detailed finite element type look at what the fire is.

14 We're still doing the soot loading
15 analysis. As we stated before, the soot loading
16 analysis -- or I think Sharon mentioned that -- the
17 soot loading analysis was done based on a correlation
18 obtained from tests. The tests that we believe we
19 represented a type of soot that we had, but it was
20 based on the solvent fire. It was not based on a
21 classic fire. We're right now going to conduct a
22 series of experiments to confirm that our initial
23 assumptions were correct, that the amount of soot that
24 we're going to generate is equivalent to our original
25 correlation.

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