DR. RYAN: Thanks.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

scavenge nitrous acid in the organic stream as well.

CHAIRMAN POWERS: Clever.

Any other questions for the speakers?

Thank you, gentlemen.

Bill, you're on again.

MR. TROSKOSKI: All right.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Did I miss one? Yes.

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

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

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

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

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

MR. ROSEN: He caught it in most places.

MR. TROSKOSKI: In most places.

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

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

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

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

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

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

cycle where HAN is introduced to reduce the plutonium.

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN POWERS: I'd have to --

MR. TROSKOSKI: We'll do the work.

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

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

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

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

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

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

CHAIRMAN POWERS: Not sure at all.

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

CHAIRMAN POWERS: None.

MR. TROSKOSKI: Okay.

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

MR. TROSKOSKI: We'll look --

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

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

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

MR. TROSKOSKI: Okay. I appreciate that.

Going on to industry events.

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

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

This is just classic chemical industry approach.

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

MR. TROSKOSKI: Yes, sir.

MR. KLASKY: Go back to the previous slide.

MR. TROSKOSKI: Okay.

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

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

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

MR. KLASKY: At last from our perspective--

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

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

DR. FORD: Okay.

MR. TROSKOSKI: Next.

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

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

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

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

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

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

MR. TROSKOSKI: Oh, okay.

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

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

Fire away, please.

CHAIRMAN POWERS: A couple of questions.

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

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

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

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

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

MR. TROSKOSKI: Yes.

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

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

CHAIRMAN POWERS: I don't know if this

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

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

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

Alex?

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

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

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

CHAIRMAN POWERS: Again, let me hypothesize that.

MR. TROSKOSKI: Sure.

CHAIRMAN POWERS: I've got a saul of

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

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

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

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

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

MR. KLASKY: Yes.

CHAIRMAN POWERS: You will?

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

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

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

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

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

One further point you had mentioned

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

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

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

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

CHAIRMAN POWERS: Good.

DR. LEVENSON: Can I ask a question?

CHAIRMAN POWERS: Only one.

DR. LEVENSON: Okay.

CHAIRMAN POWERS: At a time.

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

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

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

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

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

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

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

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

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

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

CHAIRMAN POWERS: But the requirements of

Part 70 include chemical hazards.

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

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

MR. TROSKOSKI: Right. A lot.

MR. ROSEN: Very little of it falls out.

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

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

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

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

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

Any other questions for Bill?

Okay. Let's move on to fire.

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

MR. ROSEN: And "rad all."

DR. KRESS: But I know about this hydrazine.

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

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

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

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

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

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

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

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

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

MR. ROSENBLOOM: Right.

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

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

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

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

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

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

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

is to detect and suppress.

MR. ROSENBLOOM: Right.

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

The second one is to detect and suppress.

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

MR. ROSENBLOOM: Right.

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

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

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

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

MR. ROSENBLOOM: Well --

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

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

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

CHAIRMAN POWERS: Okay. Please go ahead.

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

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

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

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

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

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

Also, so the 2 hours seemed acceptable.

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

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

MR. ROSENBLOOM: Total?

CHAIRMAN POWERS: Yes.

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

CHAIRMAN POWERS: A 1,000 pounds?

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

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

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

CHAIRMAN POWERS: Okay.

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. ROSEN: Okay.

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

extinguishers met NFPA 10 requirements.

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

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

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

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

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

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

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

CHAIRMAN POWERS: You consider seismically induced fires?

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

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

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

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

MR. ROSENBLOOM: Excuse me?

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

MR. ROSENBLOOM: That's correct.

CHAIRMAN POWERS: Presumably the bottles are? The CO_2 bottles are available?

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

CHAIRMAN POWERS: Yes. Okay.

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

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

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

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

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

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

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

MR. ROSEN: Is that part of your program?

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

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

MR. ROSENBLOOM: That's correct.

DR. LEVENSON: By implication are you

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

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

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

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

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

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

seismic event. Compensatory measures.

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

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

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

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

CHAIRMAN POWERS: Size but not frequency?

MR. ROSENBLOOM: That's correct.

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

MR. ROSENBLOOM: Correct.

CHAIRMAN POWERS: And it can be big enough

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

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

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

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

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

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

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

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

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

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

MR. ROSENBLOOM: They are small.

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

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

MR. ROSEN: Is tributyl phosphate flammable?

MR. ROSENBLOOM: It's combustible, yes.

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

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

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

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

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

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

MR. ROSENBLOOM: Right.

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

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

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

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

MR. ROSENBLOOM: Right.

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

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

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

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

sort of gets me to push the question some more.

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

MR. ROSENBLOOM: Yes.

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

MR. ROSENBLOOM: Okay.

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

MR. ROSENBLOOM: All right.

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

Now you have a good size fire going.

MR. ROSENBLOOM: Correct.

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

MR. ROSENBLOOM: Yes.

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

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

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

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

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

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

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

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

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

MR. ROSENBLOOM: It does. It does.

MR. SIEBER: And so in the --

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

MR. SIEBER: Pardon?

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

MR. SIEBER: Well, small is subjective.

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

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

DR. LEVENSON: Right.

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

MR. SIEBER: But there's a probability

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

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

MR. SIEBER: Right.

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

MR. SIEBER: So you envelop that?

MR. ROSENBLOOM: Right.

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

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

MR. ROSENBLOOM: It does.

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

MR. SIEBER: Right.

MR. ROSEN: The tanks in the room?

MR. ROSENBLOOM: It does, yes. Yes.

MR. ROSEN: As well?

MR. ROSENBLOOM: Yes.

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

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

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

Tom St. Louis with DCS.

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

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

MR. ST. LOUIS: Right.

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

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

DR. LEVENSON: Criticality keeps --

MR. ST. LOUIS: Pardon?

DR. LEVENSON: Criticality.

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

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

MR. ST. LOUIS: Okay.

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

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

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

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

analysis.

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

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

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

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

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

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

MR. ROSEN: I think you misunderstood the scenarios.

MR. KAPLAN: Okay.

MR. ROSEN: Only one leak in my scenario.

MR. KAPLAN: Okay.

MR. ROSEN: It's in a, say, pump seal. And the pump seal leak, maybe it has a tray underneath it, which is okay. And that pump seal leaks and it leaks enough to basically fill up the tray. And then overflows the tray because it's being fed from another room, not just what's in that room.

MR. KAPLAN: Right.

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

MR. KAPLAN: You would detect that leak.

MR. ROSEN: And that leak catches fire. And that's all. It's a simple thing. I think a realistic case. And I'm asking whether that was

analyzed. What's unrealistic about that?

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

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

MR. SIEBER: It's spread around.

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

MR. SIEBER: It's highly segregated?

MR. ST. LOUIS: Right.

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

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

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

MR. SIEBER: Okay.

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

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

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

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

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

MR. ROSEN: Right.

MR. KAPLAN: That's your scenario?

MR. ROSEN: Right.

MR. KAPLAN: Right.

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

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

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

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

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

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

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

MR. KAPLAN: Yes.

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

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

MR. ROSEN: Yes, detecting the leak.

MR. KAPLAN: As it occurs, right.

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

MR. VIAL: (Off microphone)

MR. ROSEN: Simple. Nasty but simple.

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

MR. ROSEN: You have no pumping loops

with--

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

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

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

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

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

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

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

MR. ROSEN: Well, this is all support for

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

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

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

MR. ROSENBLOOM: All right. Next slide.

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

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

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

MR. ROSENBLOOM: No, they don't.

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

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

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

MR. KIMURA: Steve Kimura from DCS.

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

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

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

CHAIRMAN POWERS: I hope in a lot of instances.

The trouble is I never see it so clearly

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

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

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

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

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

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

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

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

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

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

MR. ROSENBLOOM: Correct.

CHAIRMAN POWERS: That's a tough design

basis.

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

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

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

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

MR. SIEBER: Safety culture.

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

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

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

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

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

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

MR. SIEBER: All right.

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

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

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

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

MR. ROSENBLOOM: That's correct.

MR. ROSEN: No lights?

MR. ROSENBLOOM: That's correct.

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

MR. ROSENBLOOM: Right.

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

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

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

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

MR. ST. LOUIS: That's correct.

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

MR. ST. LOUIS: That's correct.

MR. SIEBER: There you go.

MR. ROSEN: Very unusual.

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

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

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

CHAIRMAN POWERS: Material at risk.

MR. ROSENBLOOM: Material at risk.

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

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

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

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

MR. ROSENBLOOM: Oh, the process cells?

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

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

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

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

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

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

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

And as mentioned before --

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

MR. ROSENBLOOM: IEEE 383.

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

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

MR. ROSENBLOOM: How many?

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

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

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

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

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

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

Go ahead.

MR. ROSENBLOOM: All right.

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

Next slide.

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

MR. ROSENBLOOM: Right now?

CHAIRMAN POWERS: To be when it's built.

MR. ROSENBLOOM: It'll probably be me.

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

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

CHAIRMAN POWERS: Okay. Okay. Good.

MR. ROSENBLOOM: Any questions?

MR. KAPLAN: This is Gary Kaplan again.

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

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

MR. KAPLAN: Okay.

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

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

the question.

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

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

MR. KAPLAN: Right no.

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

MR. KAPLAN: We'll look.

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

MR. KAPLAN: Okay.

MR. ROSEN: Thank you.

CHAIRMAN POWERS: Any other questions to the speaker?

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

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

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

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

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

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

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

And in terms of protection of structures

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

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

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

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

MS. STEELE: Well, we feel that they are

not providing sufficient power?

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

MS. STEELE: Okay.

MR. WESCOTT: Let me answer that, Sharon.

MS. STEELE: Okay.

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

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

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

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

MR. KIMURA: Steve Kimura, DCS.

There are two separate bust bars for each

system, for the C3 and the C4.

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

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

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

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

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

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

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

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

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

MR. WESCOTT: Sure. Sure.

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

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

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

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

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

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

MS. STEELE: Right.

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

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

So, can I go ahead?

CHAIRMAN POWERS: Please.

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

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

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

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

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

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

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

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

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

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

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

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

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

MS. STEELE: Right.

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

MS. STEELE: Right.

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

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

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

MS. STEELE: Yes.

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

DR. LEVENSON: Not only that, but he used combustible gloves.

CHAIRMAN POWERS: Okay. Continue on.

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

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

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

MS. STEELE: Right.

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

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

As a result of the information in the

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

In reading the construction authorization report requests, we determined that there were additional protective features provided for rooms that contained gloveboxes, such as automatic detection and suppression systems, which were already described. These are principle structure systems and components. There are manual -- the operators are able to use CO_2 manual injection ports that are in the gloveboxes to suppress incipient stage fires.

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

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

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

material.

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

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

And just -- I'm sorry.

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

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

MR. SIEBER: Zones.

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

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

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

MR. SIEBER: Disappears? Yes. Okay.

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

MR. ROSENBLOOM: Self-extinguishing.

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

CHAIRMAN POWERS: These gloveboxes use aluminum?

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

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

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

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

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

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

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

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

DR. LEVENSON: No, the transport gas.

MS. STEELE: I'm sorry?

DR. LEVENSON: The transport gas.

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

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

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

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

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

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

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

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

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

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

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

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

automatically get into the other gloveboxes?

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

DR. LEVENSON: It takes another failure --

MS. STEELE: Right.

DR. LEVENSON: Failure of the airlock?

MS. STEELE: Of the airlock.

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

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

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

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

I'm sorry?

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

MS. STEELE: Oh, okay.

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

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

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

The 2 hours is just a minimum. But we had

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

MS. STEELE: That's true.

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

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

MS. STEELE: Right.

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

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

This is somewhat related.

CHAIRMAN POWERS: Have to use the microphone.

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

Okay. This curve represents the ASTM I

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

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

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

What the applicant that was --

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

MS. STEELE: ASTM E-1929.

DR. LEVENSON: Yes. Yes.

MS. STEELE: The one I'm pointing?

DR. LEVENSON: Yes.

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

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

it.

MS. STEELE: Okay. Time in minutes.

DR. LEVENSON: 1100 degrees.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Okay. We can go back to regular.

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

CHAIRMAN POWERS: Or heat flux effects.

MS. STEELE: Heat flux, yes.

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

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

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

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

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

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

MS. STEELE: Okay.

CHAIRMAN POWERS: Because they are going to have suppression.

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

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

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

MR. WESCOTT: I think overpressurization maybe be --

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

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

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

MS. STEELE: Right.

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

CHAIRMAN POWERS: You betcha. You betcha.

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

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

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

CHAIRMAN POWERS: Like when the fire brigade comes.

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

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

And as far as responding to a fire, we do

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

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

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

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

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

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

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

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

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

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

MS. STEELE: The blowout loading?

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

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

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

MS. STEELE: Right.

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

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

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

CHAIRMAN POWERS: Okay.

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

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

MS. STEELE: Right.

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

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

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

CHAIRMAN POWERS: Questions of Sharon's presentation?

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

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

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

MS. STEELE: Right. Right.

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

MR. WESCOTT: Right. But it's my

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

MS. STEELE: More than that.

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

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

MS. STEELE: Okay.

CHAIRMAN POWERS: Any other questions?

That was very nice.

MS. STEELE: Thank you.

CHAIRMAN POWERS: That was very nice.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

rooms. Process rooms contain the gloveboxes.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

largest glovebox is 117 CFM.

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

DR. LEVENSON: A thousand rooms?

MR. ST. LOUIS: Five hundred.

MR. SIEBER: It's a big hotel.

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

MR. ST. LOUIS: Oh, no.

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

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

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

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

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

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

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

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

DR. LEVENSON: If the tornado dampers

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

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

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

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

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

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

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

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

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

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

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

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

to maintain that room at a negative pressure.

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

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

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

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

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

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

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

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

CHAIRMAN POWERS: Okay.

MR. ST. LOUIS: Based upon their materials

that are in the room.

CHAIRMAN POWERS: Good.

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

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

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

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

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

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

The glovebox internal fire is somewhat similar, although not on the same scale. All the supply and exhaust fans continue to remain in operation. The glovebox fire detectors sound an alarm. The fire brigade or operator responds with a manual CO_2 unit. But all the other gloveboxes remain to be exhausted and are continued to be exhausted through the VHD system.

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

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

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

MR. ST. LOUIS: Yes.

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

MR. ST. LOUIS: No.

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

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

MR. ROSEN: Not in the C3?

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

In the C3 confinement zone, which is where

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

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

MR. ST. LOUIS: Yes.

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

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

MR. ROSEN: By itself without any water?

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

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

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

MR. ST. LOUIS: For the fire barriers?

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

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

MR. ROSEN: Cooling to protect the final filters?

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

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

MR. ST. LOUIS: With the clean agent.

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

MR. ST. LOUIS: Yes, it removes the

oxygen.

MR. ROSEN: Removes the oxygen.

CHAIRMAN POWERS: As soon as you stop the flow.

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

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

MR. ROSEN: Yes.

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

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

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

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

MR. ROSEN: I saw a very interesting film

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

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

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

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

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

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

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

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

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

MR. KAPLAN: This is Gary Kaplan.

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

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

MR. KAPLAN: Okay.

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

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

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

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

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

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

MR. ROSEN: Yes.

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

Now your question from a fire safety

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

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

MR. KAPLAN: Right.

MR. ROSEN: -- your design is sound.

MR. KAPLAN: Right.

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

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

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

MR. KAPLAN: Right.

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

MR. KAPLAN: No. The HDE is still running

and pulling. I mean --

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

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

MR. KAPLAN: Right.

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

MR. KAPLAN: Right.

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN POWERS: Have you selected your HEPA filters yet?

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

CHAIRMAN POWERS: Paper? Are they paper filters?

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

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

Thank you.

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

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

media from severe environment stress.

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

I'll also present some basic information--

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

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

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

MR. KIMURA: Right. Right.

CHAIRMAN POWERS: Okay.

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

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

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

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

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

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

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

The HEPA filter media is designed to

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

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

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

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

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

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

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

MR. KIMURA: There are --

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

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

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

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

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

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

MR. ROSEN: The two filters?

MR. KIMURA: Two filters in series.

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

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

DR. BERGMAN: Warner Bergman, consultant for these.

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

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

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

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

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

Thank you.

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

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

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

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

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

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

Number four filter is more traditional

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

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

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

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

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

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

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

downstream.

DR. KRESS: Just checking the efficiency?

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

DR. KRESS: Right.

CHAIRMAN POWERS: Do you have to worry about knock-through?

MR. KIMURA: Are you worried about the knock-along effect or --

CHAIRMAN POWERS: Yes.

MR. KIMURA: -- alpha recoil?

CHAIRMAN POWERS: Yes. It's not through unfilters, knock-along in ducts.

MR. KIMURA: Can we go to the backup slides. Slide 16.

We conducted a review of the literature on the subject going back over about 30 years. In fact, it was 29 years to 1974.

We have concluded that the knock-along effect is inconsequential in regards to the total amount of material that could pass through two stages of HEPA media. As stated by Gonzales, Elder and Ettinger, the measure of HEPA filter efficiencies remain well within present minimum AEC performance

guidelines for each stage. And they quote some numbers here.

And they said that the second stage HEPA filter efficiency exceeds 99.99 percent.

Since that time, this was back in '76, since that time no direct statistical -- significant evidence has been presented that contradicts the basic conclusion reached by Gonzales, et.al. that the protection factor of the two stages of HEPA filters can be shown to be greater than 10 to the 9.

Next, 17.

This is a fairly busy slide. It presents probably what everyone would consider the -- I guess the father of knock-along effect in HEPA filters.

Niels Hetland and John Russell in 1974 were doing a survey of Rocky Flats plants various filter. At Rocky Flats Building 771 they have about 39 grams on average of plutonium on every one of their HEPA filter elements.

They used a drum counter, which picks off the activity from the entire 39 grams, and measures it to an accuracy of plus or minus 2 grams.

In the second stage filter they tried to use the same drum counter and measure 390 micrograms of plutonium. And on the third stage 3 micrograms. And

on the fourth stage 0.5 micrograms.

What Dr. Bergman had stated was that when you do that, these two filters get dominated by the background effects. It gets very hard to increase the counting time long enough for you to get an efficient measurement. You would actually probably have to count for several years in order to get sufficient accuracy in those counts.

CHAIRMAN POWERS: It's background dominating, you can count until the end of time it won't help you.

MR. KIMURA: Right. Just to get an accurate count on the source itself.

CHAIRMAN POWERS: It just won't do you any good.

MR. KIMURA: I have several more slides that just show the history of the effects. I don't know if we want to --

CHAIRMAN POWERS: Well, we know the history of the effect. We know that -- I mean, there's this great Los Alamos film of showing it actually happening. I mean, the particles do move because of the recoil effect.

I mean, Ettinger's a great guy. Why he is so confident this thing's not going to work? I mean--

DR. BERGMAN: Warner Bergman again from DCS.

If I could just add to both this knock-along and a very closely related thing of what's called alpha creep.

Both of these phenomena kind of get bashed around without a lot of real detail scrutiny to the point where, like for example, at Livermore half the scientists that actually have working experience with actinides swear by it, the other half say it's a wives' tale.

And so, for example, the alpha creep has only recently been elucidated with funding from Stockpile Stewardship, of which they wanted to know very precisely what happens over long times with plutonium and alpha materials. And papers published within the last two years show that even room air, if you expose a slab of plutonium, or small -- even plutonium metal, very tiny particles are omitted. And even the act of opening up a can or opening up a glovebox door creates sufficient turbulence to release some of these. And so if you come with a measurement instrument, then you find it dispersed throughout the glove.

So this is ongoing research. Only two

papers have been published so far, but the idea is that the thing of popping off ideas is not valid for that particular thing. However, another class of research being done in basic nuclear physics, again primarily supported by Stockpile Stewardship, of which both experimental and theoretical computations that are related to alpha omissions. They're not studying alpha omissions per se, the recoil and then the subsequent chunks popping off. What they are studying is things like spattering the -- where they bombard pieces of metal with high energy ions and other materials. And these, they create external excitations, very similar to what happens with alpha recoil in principle. And they have found the initial studies that McDowell and some of the people many years ago, what they speculated was in fact verified experimentally. And the current, both experimental and theoretical simulation studies, show that the number of particles decrease. You can find 500 popping off parts, up to 500 atoms, they speculate even a 1,000 atoms. The problem is the probability of each one of these events is one over the number of atoms squared.

So it doesn't take very long before you have ten to the minus ten probability. So even though the phenomena that was speculated 20, 30 years ago is

valid, there's no question about that, both theoretical and experimental, the actuality of it it's inconsequential. It's such a small event.

So the unfortunate thing, much of the research hasn't been put into the literature that it's available to everyone at present. And we're trying to correct that situation and maybe publish something in Nuclear Safety, or something of that nature.

So, thank you.

CHAIRMAN POWERS: Nuclear Safety is no longer an extant journal.

MR. KIMURA: I just want to make one concluding remark on that. During the '70s, the late '70s through the '80s a lot of speculation occurred as to whether the ultra-fine particles that you would get from this alpha particle decay would pass through HEPA filter media. Between those ten years, 1988 and 1998, there is a large number of investigators that looked at the retrainment principles and what happens with ultra-fine particles and they found the classical filtration theory that these small particles tend to go to zero penetration or unity on efficiency.

Have to go back.

Any other questions?

Okay. Next slide. I think we covered

everything on this one.

When Tom went through and talked about intermediate filters on the room air, this is just a picture of that.

Next one.

This is actually a picture of the roughing filter, a full sized prototype.

Under typical installation you would see a spark arrester with just this expanded metal cage, and they call that a spark arrester. What we have done is we have gotten this with the expanded metal on both sides and some re-enforcing bars. But inside is stainless steel wool, so to speak. It's stuffed into here to form the roughing filter. And that's going to be collecting the filter media.

Okay. My next slide is just a half sized prototype of the high efficiency prefilter with the re-enforcing bars in this fiberglass wool with stainless steel fibers intermixed into it, inside of a stainless steel box.

This filter is designed to be 99 percent efficient for particles greater than 2 micrograms in size and greater than 90 percent efficient for particles less than 1 micron in size, which is soot.

Okay. Next.

This is a picture of the HEPA filter element. In the past the frames have been made with wood and with stock wood. This is actually more fire resistent than steel in some cases because of the warping capability. But the way this is constructed, the steel is a stronger -- structurally stronger design.

Filters are designed to withstand 400 degree fahrenheit continuous service. And our test did up to 5 minutes at 700 to 750 degrees, so they can still be efficient at even extreme high temperatures. There's a screen on the front and back that helps protect against blowout, but otherwise the filter media itself is noncombustible.

CHAIRMAN POWERS: What is it?

MR. KIMURA: Glass fiber.

And it's tested to be 99.97 percent for .3 micron size particles, and that corresponds to the 99.9 percent at the .1 fine micron most penetrating particle size.

This lip here will actually be filled with a sealant material, and that goes into a knife edge and then forms a robust seal for the filter. And that's part of the anti-bypass design.

The testing, the manufactured tested

design for the efficiency pressure drop rough handling. They shake it three quarter inch vibration table. Pressure, moisture, heated air, pinhole leaks and spot flame resistance. They put a blow torch to it and make sure it doesn't burn through.

Before any filter leaves the manufacturer, they test it for final efficiency before shipment.

Once it gets to our site and gets installed into the filter housing, we do in situ tests to insure that the filters were not damaged during shipment and that they've been installed properly.

And the test, it will insure that we met our efficiency requirement, that they structurally withstand greater than ten inches of delta T across them and with 700 degrees for up to 5 minutes.

CHAIRMAN POWERS: This in situ testing that you do, once you've installed it, that's under your Appendix B program?

MR. ST. LOUIS: Yes.

CHAIRMAN POWERS: Because I have seen installations that had all of this, that you could have borrowed their slide. And the problem is people get tired of doing this and so they slope them together, write down, yes, tested it. And you find out you can put your finger in the gaps that they

leave.

MR. ROSEN: Not in the nuclear industry, of course.

CHAIRMAN POWERS: Not in the U.S. commercial nuclear industry, and definitely not in South Texas.

DR. KRESS: You test every one of the filters, of those last three items or you sample them?

MR. ST. LOUIS: No. All the HEPA filter are individually tested. And the --

DR. KRESS: You subject them to ten inches of H_2O pressure --

MR. KIMURA: No. This is a sample. Ten inches is a sample.

The efficiency, everyone is tests for efficiency.

DR. KRESS: But you sample?

MR. KIMURA: But we sample for the ones that could physically damage them, because --

DR. LEVENSON: The problem is those lost two things don't apply to the bullet above it.

DR. KRESS: Yes.

DR. LEVENSON: I mean, the bullet above is installed and this is an insert. It sort of reads like you're testing the installed ones at 700 degrees.

And I don't think so.

DR. KRESS: That's what caught my attention.

MR. KIMURA: All right. I think we've covered everything we need to cover on this slide.

HEPA filters have been studied for a long time. The effects of what they do and how they work, and what causes them to break are pretty much known. There are short term physical effects. Essentially the big categories are they leak, they can clog and they can burst. And what causes that are embers, smoke, soot, high temperature, moisture, water, air flow.

There are long term effects that are lumped together under the category called aging. And these may have to do with chemical exposure, exposure to moisture or water and radiation damage. Other factors could be, you know, you get a bad filter, manufacturing defects. You can install it wrong. You can damage during installation.

Inspection errors. You don't inspect or the inspector misses something.

DR. LEVENSON: While the concept has been around for 50 years, the particular media you're using I don't think is quite that old. How old is -- how

much experience is there with the actual media you're using? Media in the HEPA filter itself?

MR. KIMURA: The media we've been using is pretty much been in service since the early '60s.

In 1969, which is the Rocky Flats fire, they had noncombustible HEPA filter media. The previous fire in 1950 was paper, and paper was easily ignited.

DR. LEVENSON: Was the '69 the same media you're using? I mean --

MR. KIMURA: No.

DR. LEVENSON: How long -- what's the history on the actual media you're using?

DR. BERGMAN: This is Bergman.

The media changes every year. The media that existed back in the -- Arthur Doolittle, when they first did the work with the Army to develop the first HEPA filter and then with Cambridge. Cambridge formed as a consortium for them. That started out with asbestos and paper fibers. Then Wendell Anderson and others helped develop with glass. And every year they learned improvements making glass smaller and smaller, different formulations, thicknesses. So each -- there is a development across time, and I'm sure the filter we have tend to be different than what we have now.

The trends are smaller fiber diameters within economic trend and higher strengths. So formulation change to improve the efficiency, reduce the pressure and increase the strength. So those are the changes that evolve over time.

DR. LEVENSON: Yes. And those three can be tested, but the question of the aging you can't go back and say there's X years of experience, but your media is only a couple of years old.

DR. BERGMAN: You're absolutely right. And we had -- that precise point was a great consternation to a problem we had for establishing age limits on HEPA filters. We were comparing apples and oranges and we wondered why there were a couple of papers that were presented. I mean, we're talking about an order of magnitude of variation of data. And it's like a moving target. We were comparing filters 20 years ago with the present time, and in some cases some manufacturers had better media 20 years ago than some today, you know, But this was the variability.

So, it's a very complex issue. And so the latest trend as far as aging is concerned is to use them -- we've used and written a paper using the most conservative numbers and it's in coincidence with Mel First and some of his studies and helped establish age

limits for HEPA filters precisely to address some issues like that.

DR. RYAN: You mean age in service or age on the shelf, or both?

DR. BERGMAN: Both. A filter will degrade even if it's sitting on the shelf for 5 years.

DR. RYAN: What is that age limit now?

DR. BERGMAN: Right now based on all of the available data we've had with -- which Jon Fretthold generated at Rocky Flats, for what we call a very dry situation, we say 5 years. And for -- I mean, for a situation where you can have moisture exposure, because filters like most tissue will get soft and that with water. So 5 years for a wet application, ten years for an application that's dry. And by dry, I don't mean the last incipient fire, but where you have like a water spray and other potentials to really wet things down.

MR. KIMURA: All right. The MFFF design in addressing the factors that impact the HEPA filter media, on embers, and as I stated, we have the high strength roughing filter, it collects the embers, collects the hot particles, the brands. It can burn holes through the more delicate HEPA filter media.

Soot, again, if soot collected on the face

of the HEPA filter, the delta p's can go up very high, greater than 10 inches and eventually causing bursting. To prevent that, we mitigate it by use of the high efficiency prefilter. And those filters collect the soot, withstand the delta p's. Only a small amount of soot gets onto the final HEPA filters so the delta p across the final HEPA filter stays very low.

High temperatures. We mitigate that just by the design of the filter media itself and the filter element so that they're noncombustible.

The sealing is noncombustible that we use. In the past, urethanes that actually burned have been used and other materials that you wouldn't think, while the entire HEPA filter itself is said to be noncombustible, the wood frame if you get it hot enough will burn.

The other factor that we have is dilution air flow. As Tom said, there is a lot of other noninvolved areas once we have a fire. So all these other flow areas act to dilute and cool down the flowstreams.

High moisture. Again, when you have a fire, fire generates a lot of moisture just in the act of combustion. That's mitigated by dilution air flow,

that lowers the relative humidity of the gas stream.

DR. LEVENSON: Dilution air flow protects only your final HEPA filters. It does not protect the regional ones, right?

MR. KIMURA: Right. And what we're doing here on the final HEPA filters is protecting the public. We're keeping the material from leaving the stack or entering the stack.

Entrained water. In 1980, Rocky Flats fire entrained water from the water strays sprayed directly on the HEPA filters was implicated in causing them to be blown out and causing more damage than the fire that occurred on the HEPA filter media itself.

As a result, that's why we depict dilution air flow over water sprays to mitigate that, or prevent that happening.

DR. LEVENSON: You don't really mean you're dilution air goes over water sprays? You mean instead of?

MR. KIMURA: Instead of. In lieu of.

Okay. High delta P across the HEPA filter media is caused by how many things there are to burn, how much soot you generate that's going to clog the filter, that's going to cause the high delta p.

We have combusting loading controls in all

the fire areas, and then all the filter elements, not just the high-strength prefilter elements, have defense-in-depth monitoring for differential pressures so we can monitor during normal operations, change out the elements to make sure they're clean before an event happens.

Aging, as we said, can occur because of chemical exposure. There are two sets of filters being used. For the HVAC system, there are no chemicals that the filters are exposed to on a routine basis. The process ventilation fumes where you get most of the chemicals are exhausted off of separate flow screen, which is a very small airflow, 2 -- 300 CFM. That gas gets treated before being released. So that the big filters, the ones that do the ventilation air, have no chemicals.

Radiation exposure. Unlike other facilities we have many, many filters upstream of our final HEPA filter elements. We don't expect to have the high radioactive material load on the final HEPA filters that causes problems. There's some periodic inspection and maintenance to these that go along to insure there is no build up.

Moisture. The moisture has been indicated in reducing HEPA filter media strength after a short

exposure and redrying. You can seriously degrade the strength of the HEPA filter media. So exposure to moisture is part of our facility's design features to keep the relative humidities under control in the areas where water can get into the air.

In order to insure that these severe conditions don't impact the HEPA filters, we've done a series of analyses and plan to do a series of analyses for those that aren't complete yet. We have a Fire Hazard Analysis, which looks at the total fire loads.

Fire severity modeling, which does a more detailed finite element type look at what the fire is.

We're still doing the soot loading analysis. As we stated before, the soot loading analysis -- or I think Sharon mentioned that -- the soot loading analysis was done based on a correlation obtained from tests. The tests that we believe we represented a type of soot that we had, but it was based on the solvent fire. It was not based on a classic fire. We're right now going to conduct a series of experiments to confirm that our initial assumptions were correct, that the amount of soot that we're going to generate is equivalent to our original correlation.