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COMANCHE PEAK MEETING

PROTECTIVE COATING INSIDE CONTAINMENT

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COMANCHE PEAK MEETING
PROTECTIVE COATING INSIDE CONTAINMENT

R. G. Tolson	TUGCO
Spottswood B. Burwell	NRC/NRR/DL/LB#1
Clifford Leune	EBASCO/TUGCO
Jerome I. Firtel	EBASCO/TUGCO
Michael A. Viviritu	GIBBS & HILL/TUGCO
D.C. Purdy	GIBBS & HILL/TUGCO
M. Chiruvolu	GIBBS & HILL/TUGCO
Richard Bangart	NRC-Region IV.
T. A. Ippolito	NRC/DL
A. W. Serkiz	NRC/DST
J. A. Kudrick	NRC/DSI/CSB
Chang Li	NRC/DSI/CSB
L. F. Fikar	TUGCO
J. B. George	TUGCO
J. W. Beck	TUGCO
B. R. Clements	TUGCO
H. C. Schmidt	TUGCO
J. J. Stefano	NRC/DL
J. S. Marshall	TUGCO
Robert C. Iotti	EBASCO (TUGCO)
James Wing	NRC/NRR/DE/CMEB
Conrad McCracken	NRR/DE/CMEB
Annette Vietti	NRR/DL
E. Marinos	NRR/DSI
Sammy Diab	NRC/RSB
Joe Youngblood	NRC/LB#1
Gilbert Kaback	G. A. P. for C. A. S. E.
Richard Bachmann	NRC/OELD
P. R. Matthews	NRR/DST/SPEB
N. S. Reynolds	Bishop, Liberman, Cook, Purcell, & Reynolds-Applicants
M. H. Philips	Bishop, Liberman, Cook, Purcell, & Reynolds-Applicants

PROCEEDINGS

MR. BURWELL: Okay. Fine. I'm Spottswood Burwell, Project Manager, NRC, Comanche Peak, and we are gathered here at the request of the applicant to review and to discuss information he's provided to us.

The information was provided to us in a letter dated June 4, 1984, Log TXX-4189. This particular letter includes in some proposed draft, changes in an FSAR amendment -- an amendment to the FSAR. It also included three reports which were entitled, one by Ebasco Services, entitled Analysis of the Clogging of ECCS Sump Trash Racks by Debris and Paint Peels Following an Accident. Another prepared by Gibbs & Hill, Evaluation of Paint and Insulation Debris Effects on Containment Emergency Sump Performance. And the third entitled -- this one is by Western Canada Hydraulic Laboratories, and this one is entitled Model Testing of the Recirculation Containment Sump.

I note that the last report by Western Canada Hydraulic Laboratories is dated November 1983, and was provided to the staff earlier, I believe in early 19 -- woops, excuse me, November 1981. And I believe it was provided to the staff in early 1982, and is already a matter of record.

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The letter and these reports have been placed in public document. With that, I believe that the applicant has prepared an agenda and has prepared a presentation, I guess outlining the content of its report -- of the report and its analysis. I would like to inquire whether you would desire to just go through your presentation without interruption or whether you would like to hold -- a -- ongoing free floating discussion.

UNIDENTIFIED SPEAKER: I'll address that.

MR. BURWELL: With that, unless there's a further statement to be made, I'll turn the meeting over to the applicant.

MR. FIKAR: I'm Lou Fikar, Executive Vice President of TUGCO. We have quite a few people here with us today, and I'd like to just briefly introduce two of the other officers from TUGCO. Mr. Bill Clements, our Vice President in Nuclear Operations and Mr. Joe George, our Vice President and Project General Manager for Commanche Peak.

What we'd like to do today, to address the, the questions, response addressed, is we'd, we'd like to go through our presentation. We think this will probably run an hour, an hour and a half or so. We're not real sure, but we'd like to go through it. And it would probably be more expedient if you'll save your questions to the end, but if, if you just have to, well, obviously, we'll respond.

What we're going to do today, as shown on our, our agenda, is Joe George, our Vice President and Gen -- Project General Manager will, will tell you about why we're here and the details of, of why we bought the study. Following that, Mr. Dave Purdy with Gibbs & Hill will give a -- his summary of what his study show on the sump performance at Comanche Peak. Following that, Dr. Bob Iotti with Ebasco will come in and show you the highlights and results of the Ebasco study. Following that, Joe George will give you what we propose is our practice from here in. And then after their through, I'll, I'll close the meeting.

So, with that, I'll turn the meeting over to Mr. Joe George.

MR. STEFANO: May I interrupt just a moment to say that the applicant has provided a copy of the slides that he's using in today's presentations, and these will be bound in the transcript at the end. Thank you.

MR. GEORGE: Thank you very much, Mr. Fikar. As the Vice President and General Manager of the Comanche Peak project, I have the responsibility for the engineering, construction, licensing and fuel procurement.

And I would like at this time to present to you what we propose to do here today. We have had studies of containment coatings underway for sometime, to review the need for those coatings being safety related. Clearly, sump performance is the only reason to require these coatings to be safety related.

Thus, essential to these studies is the sump performance. Further, the studies were executed following review of NUREG-0897. We have received and delivered to NRR reports on detailed studies of containment coatings by our architect engineer, Gibbs & Hill. We have also received and delivered to NRR a bounding report of sump performance studies by Ebasco, our independent, -- retained to provide us added assurance in this matter. And as stated, earlier we had had Western Canada Hydraulics do a full scale model of the sump behavior under a DBA condition, and this study has been given to the staff.

Based on these reports, coatings inside containment need not be safety related as they have no significance to safety. Today we will present reports, detailed reports on these studies findings.

Following the meeting, we will be available in Bethesda today and tomorrow and whatever the need be, respond to any questions and further discussions on these reports.

Prior to these detailed presentations, let me introduce you to the Comanche Peak plant specific containment that we will be discussing. This is a concrete steel reinforced structure, both external and internal. The structure is 260 feet tall and has a diameter of 135 feet. It has four major elevations across the entire containment that are steel reinforced concrete. And as you will hear in the detailed discussions, these have terms. And I submit that this particular design certainly prohibits the transport of debris to the sumps in this area.

With that introduction to this structure, let me call on Mr. Purdy to commence giving you the details of the Gibbs & Hill study.

MR. PURDY: Good morning. I'm Dave Purdy, Gibbs & Hill, consultants of TUGO. John, I wonder if you could move out because I'm going, going to be spreading a couple of things here.

MR. BURWELL: Mr. Purdy?

MR. PURDY: Yes.

MR. BURWELL: When you go througn your presentation, if you would make some reference to when you change slides and which slide you're on, we'd greatly appreciate it.

MR. PURDY: Okay. Okay.

MR. BURWELL: It makes it a little easier to follow in the transcript.

MR. PURDY: Yes. Well, the first slide which is up now is sort of an unentity -- it's just an introductory slide. We'll take that off rapidly.

The next slide is an -- is an introduction to the subject. My purpose is to discuss the report we prepared, but before doing so, I have to set the stage a little bit and give you some background on the design of the containment and the factors that we are considering.

The first subject to be discussed is why we have coatings inside the containment. Fundamentally, they serve two purposes. One is to prevent corrosion, principally of carbon steel materials inside the containment.

The second major purpose is to facilitate decontamination following minor spills and operational errors inside the containment. The idea is that the -- this ties into the -- as well as the reasonably attainable requirement, and by providing a means

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from decontamination, it reduces the total radiation dose to operators during the operation of the plant.

Now, having provided the coatings for these two purposes, we then must look at the effect of these coatings upon accident conditions. We have isolated three possibilities as shown on this slide. And we're going to focus our attention for reasons you'll see shortly upon the first one, that is, performance of the ECCS systems.

There are two systems that could be affected by failure of the coatings inside the containment. The containment spray system takes water from the sump after the recirculation phase has started. It passes through a pump, through a heat exchanger, and then through containment spray nozzles located in the containment dome and under -- just underneath all the floors in the containment. This is an unusually well sprayed containment because we do not depend on ventilation systems to remove iodine.

The function of these sprays is to remove heat from the containment and also to remove iodine from the containment atmosphere.

A limiting parameter in the containment spray system is the spray nozzles themselves, which in order to provide a spray pattern have to have small arfices (Phonetic) in them. The arfices are one-eighth of an inch in diameter.

Now, in order to meet the parameter or the requirement that the nozzles not be blocked, we have provided a system which, first of all, will pass an eighth of an inch particle through the pumps, through the heat exchangers and also at the beginning, through the sump screens. In other words, a basic design requirement on the sump screens has been to provide holes of one-eighth inch diameter so that a particle which can block the arfices cannot get into the system and cause -- trouble.

The other system that is a part of the recirculation system is the OHR system, using Westinghouse nomenclature. The function of this system is to pool the core in well post DBA conditions, that is to say after depressurization has taken place. It shares the sump and the sump screens with the containment spray system. It, too, has been designed so that the pump would pass one-eighth inch particles, but, of course, it does not have any containment spray arfices and, therefore, no further restriction downstream of the pumps and the heat exchangers.

A second system that could potentially --

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not a system, but a second category that could be potentially affected by failure of the paint is the quantity of hydrogen generated following the design basis accident. However, as it happens in our evaluation of this phenomenon, it was assumed that the zinc rich primer coat reacted completely with water to limit hydrogen. And it, therefore, does not matter whether the paint fails or not. The same total amount of hydrogen is assumed to be generated, and that amount of hydrogen is used in the design of systems such as the recombiners to insure that the explosive limit is not reached.

A third potential possibility is ventilation system performance, but as it happens in Comanche Peak, the ventilation systems do not operate post DBA. All heat removal and iodine removal from the containment is via the sprays. So that we do not need them post DBA.

There are also no systems with filters that are required for safe shut down in the absence of accidents. So, that we can eliminate any affect from ventilation system performance from consideration in the safety of the power plant.

Now, very briefly, I want to tell you what the coating materials are because it sets the stage further for the study. On steel surfaces we use an inorganic zince primer, carboline (Phonetic) 11. We use an epoxy modified phenolic finish as an over-coat. It's phenoline 305 (Phonetic), on all the surfaces that are painted in the field.

There is also a system used to repair services called carboline 191. It's an epoxy polyamat (Phonetic). It's use is limited to a very small fraction of the total area of the containment because it's only used for a tug chuck (Phonetic) purpose.

On concrete surfaces, we use an epoxy surfacer and an epoxy finish provided by Imperial Professional Coatings Incorporated.

MR. BURWELL: I would like to note that Mr. Purdy has been talking from --

MR. PURDY: Yes.

MR. BURWELL: -- Slide No. 5 and is moving to Slide No. 6.

MR. PURDY: Yes. I will -- and it's Slide No. 7 that I will talk from next. This is further stage setting, you might say, is a brief description of what the sump system is like.

As I said, there are -- well, I didn't say this. There are two sumps in the containment, a Train A

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sump and a Train B sump. Either one is sufficient to cope with the design basis accident.

On each sump there are two containments, spray pumps and one RHR pump. Obviously, all the Train A pumps are attached to Train A sumps, and Train B pumps are attached to Train B sumps. They are also shown on this view of the containment which has the sumps outlined in red. This drawing on the wall here is a planned view of the basic level of the containment.

The sumps themselves are -- the sump screens themselves are covered structures. This is an impervious solid steel plate that forms a cover over the sump. The screens are on the side of the sump. And they are actually three levels. There's a trash rack. There is a coarse screen. And there is a fine screen. All these -- the trash racks and the screens are all on vertical surfaces. We'll focus most of our attention on the fine screen because that is where the smallest openings are. The openings that I said before are approximately one-eighth inch. They happen to be square openings because the screen is made of woven wire.

I'll move on to Slide No. 8. Now, the design criteria, then, for the sump are, in brief,

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that one sump suffices to cope with the accident. In accordance with the regulation guide 1.82, in the original design of the screen, we assume an arbitrary non-mechanistic 50% blocking of the screen.

And, thirdly, when the safeguards actuation signal operates, it activates all pumps attached to both sumps. This is important because while we can get by with one sump, to cope with the accident with one sump, what actually happens is that all the pumps operate, both sumps operate. And this maximizes the velocity of water inside the containment, which in turn maximizes the transport of paint within the containment. And that, therefore, is the condition that we actually use in our study.

Now, having set the stage so elaborately, I am prepared to move into a discussion of the study itself, using Slide No. 9 as a starting point. Excuse me, I have one more piece of stage setting to do, and that uses Slide No. 9.

I want to talk a little bit further about sump performance requirements. As noted earlier, we had full scale testing done by Western Canada Hydraulic Laboratories. They used these parameters which are taken from our design basis accident requirements and the design of our system, and they

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obtained these results.

Now, at the 50% flow blockage criterion used in reg guide 1.82, they evaluated ahead at 0.011 feet loss through the total screen system, trash rack and screens. And, of course, they use -- they provided these numbers -- losses to the pipes inside the sump.

Now, actually, the -- to what you had there was a little bit more elaborate than that. They -- their task was to prove by experiment that the sump performance was completely satisfactory. That means not only pressure drop losses but it also means no vortexing, no -- of air and no cavitation.

They ran additional tests well beyond the 50% flow blockage criteria. They ran tests as high as 93% flow blockage and showed that the performance of the sump was satisfactory under these respects. There was more pressure drop, obviously, through the trash racks and screens, but it was within the limitations of that part of the sunction heard required to the pumps and there was no cavitation, no vortexing, etc., was a completely satisfactory system even under the 93% flow blockage criteria. And, of course, under this 50% flow blockage criteria, the margin against that part of the sunction head in the pump is 8.5 feet for the RHR pump and 8 feet for the spray pumps. This is based not only on the full scale experimentation at Western Canada but also cn full scale tests of the pumps themselves.

So, the parameters you see on this slide have all been verified by full scale experimentation.

MR. IPPOLITO: Question.

MR. PURDY: Yes, sir.

MR. IPPOLITO: Tom Ippolito.

MR. PURDY: Yes.

MR. IPPOLITO: Does that report, that Western Canada report include in it the fact that they ran the test in excess of 50% blockage?

MR. PURDY: Yes, it does.

MR. IPPOLITO: And --

MR. PURDY: It has the detailed test information that is -- and the statement about vortexing, etc. inside the report.

MR. IPPOLITO: And does it also list the NPSH at these higher --

MR. PURDY: No, it does not list the NPSH because they did not test that. The NPSH has to be extracted from our calculations.

MR. SERKIZ: Al Serkiz. A point of clarification, Mr. Ipppolito. The Western Canada

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tests established to investigate hydraulic characteristics almost in their entirety. The blockages that were put in there were assumptions on certain types of blockages. Those blockages are not necessarily characteristic of the type of materials we're going to be discussing today.

Furthermore, the Western Canada report does contain the test data but does not contain the head losses for the 93% blockage or on the order of 90%. I have made contact with people of Western Canada to get their imputs on that additional data and interpretation thereof. I don't have an answer. I would expect to get back to them today.

The principal point I want to make is those are hydraulic tests, and they are not necessarily representative of blockage by any type of material.

MR. PURDY: That's correct. The blockages are arbitrary. They did -- at that -- at that point in history, they had no knowledge of the studies that we subsequently performed and, therefore, they were limited to arbitrary blockages.

Okay. Now, we can get down to the study proper using Slide No. 10 for starters. What I want to explain first is the major assumptions that were made in the study. And there is one assumption that

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deserves an especially large amount of attention. That is the size of the paint particle assumed in the study.

We, by and large, used methods, proposed a new reg 2791 in our analysis. And there are a number of formulas in there that tell you how to calculate the possibility of transporting particles in a -- in a given velocity.

The study, of course, was aimed at insulation, but there are types of insulation that are similar physicially to the paint flecks that we will obtain if there is a paint failure.

Now, I've got to do this by stages. First of all, what this graph basically shows is paint particle size as a function of required transport velocity and by required transport velocity, we mean the minimum velocity that will transport a paint particle of a given set of characteristics.

Now, there are no numbers on this slide because it is a generalized slide, principally to get across a mechanism. The point I want you to focus on, initially, is that for a given particle size, for a given particle characteristic, that is to say shape, etc., you can make a graph that shows you what the required minimum velocity is as a function of particle size. And the lesson we tried to draw from this slide is that small particles are easily transported and large particles are less transported.

So that if we want to make an assumption as to particle size, transportation is facilitated by assuming a small particle size. Now, the truth of the matter is that there is no analytical way to determine how large a paint particle is going to be. It's the old problem that we have that we design things where they can't fail and then you have to ask yourself what they're like after they fail. In other words, we used qualified coatings inside the containment which we don't expect to fail. And, therefore, we're in the state of ignorance as to what they would be like in a hypothetical case if they did fail.

So, what we decided we would do in the interest of producing a reasonable analysis and to assume the worse case, that is the most conservative assumption we could make as to particle size. Now, as I said, it is easier to transport a small particle, but if a particle is small enough, it will get through the one-eighth inch hole in the screen and the one-eighth inch arfices in the RHR pumps and, therefore, not interfere with the system's performance.

The smallest particle and the most easily transported particle that affects ECCS performance is approximately one-eighth of an inch in diameter in a shape of a disc with a thickness equal to the thickness of coating that we have on the wall. And I think -- we, therefore, assume that uniformally all the paint failed at a one-eighth inch particle.

(PAUSE)

MR. PURDY: On Slide No. 11. It is also apparent from the form that's given in NUREG 2791, that light particles are easier to transport than heavy particles. We, therefore, again conservatively assumed that all the paint had the specific gravity of the lightest species of paint present in the containment. That is enoline 305 (Phonetic). That has a specific gravity of 1.5.

The concrete coating has a specific gravity of 1.8, and the thin coatings have a specific gravity of 4. Yes, sir.

MR. SERKIZ: Just a point of clarification --

MR. PURDY: Yes.

MR. SERKIZ: -- for the record. The report that's been referenced several times is NUREG CR 2791. It is not a staff report. It is a contractor report.

MR. PURDY: Okay.

MR. SERKIZ: NUREG/CR 2791.

MR. PURDY: Now, the next two assumptions -- well, the next assumption is possibly one of the more minor ones in the report, and that is to say that if we have a region where you have a general flow velocity sufficient to transport paint, there can be local regions like behind a post where the velocity is low and paint which had to file up against the supports cannot be transported. We ignored such affects. We call that hide-out. And we say that if there's a region where the general flow velocity is sufficient to transport paint that exists throughout the general area, there's no loss -- and hard points within the system.

Again, a high velocity will transport paint more easily than a low velocity. And we, therefore, used, I think I mentioned a few slides back, we used the maximum water flow that will obtain in the recirculation phase post DBA, post sumps operating and all pumps operating.

We also used a DBA depth of water that -- inside the containment in our analysis. And, finally, we assumed a zero, zero permeability of paint debris. And that, too, needs a little bit of explanation. If you have a vertical sump screen and paint piled up against it, the paint debris pile is in reality, to a certain extent, coarse. It is not solidly packed. And there is, therefore, the possibility that there will be some water flow through the pile of debris into the screen.

We, again, conservatively assumed that there was no such flow, that in the event of a debris pile all the flow was over the top of the pile and into the unblocked portion of the screen.

Now, we can go into the actual -- well, I wanted to put on Slide No. 12, which is a brief outline of the study. It has three phases; debris generation, debris transport and effects of debris on sump performance.

Now, the, the debris generation step we simplified very much. We just said that it all failed which is about as -- well, it is the most conservative assumption. That is we took no credit for the paint adhering to the walls but in spite of the fact that the paint system had been -- qualified and the paint application procedures had been DBA qualified.

The debris transport,we'll get into in a little bit more detail in a moment. And then the third step

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is the effects of debris on the performance of sump itself. Yes, sir.

MR. SERKIZ: Question for clarification. When you referred to debris in Slide 12, are you referring to debris from paint only or debris in general?

MR. PURDY: That's a good question which I do want to clarify. The Gibbs & Hill report considered insulation debris as well as paint debris. We're going to talk mostly about the paint debris because paint is the subject of today's meeting, but I will say that, first of all, most of the insulation inside the containment I've mentioned to you is reflected metal insulation which is difficult to transport. And there is some other types of insulation in there. Principally, there is some high efficiency insulation in very limited areas near -- with supports. And there is some fiberous insulation on cold water piping.

And under DBA conditions, especially, there is very little of this insulation available to transport to the sump. We did assume that the fiberous insulation that is dislodged by the DBA reaches the sump. We went through the pressure drop of this insulation on the sump screens and found that it was very minor

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compared to the paint debris effects.

Now, we can talk in a little bit more detail about the study methodology on Slide 13. Now, the report is not presented in this order. That is to say that what I am doing here in describing the study methodology is stepping through the report in a manner which is designed to help you understand it. When you read the report, you'll find that the organization is a little different.

Okay. The first step was to determine the critical particle size. We have discussed this previously in another slide in a fair amount of detail.

The next step we want to describe is the accumulation of paint on the screen. In this case, Slide 14 shows you a picture of what the accumulation of paint particles on the screen looks like. The -- for this purpose, what we wanted to do was to calculate the amount of paint which could accumulate on the screen without cheating the other -- non-mechanistic assumption of 50% screen blockage. And, of course, that's the assumption made of reg guide 1.82, that we have confirmed by full size experiments that we can stand up to 93% flow blockage instead of a 50% flow blockage. That's used as a criterion.

In determining the characteristics of the paint pile that acummulated against the screen, we, again, used methods in NUREG/CR 2791. They have, as I said before, materials that are physically similar -- paint that is, that we used the methods there to estimate two parameters, the angle to be posed and the density or the packing fraction of the painted -- on the screen.

Using the data from NUREG/CR 2791, the angle to be posed was calculated to be 45 degrees. The packing fraction was calculated to be 50%; is that right -- when you said 50% packing fraction, that is the overall volume of the pile double the volume of the paint chips themselves.

And the result of this calculation was that in order to achieve 50% flow blockage, you would have to accumulate 117,000 square feet of paint on the screen.

Now, I want to return to Slide No. 13, again, for a moment, but we're going to move on to the next step. Step 3, determining the hydraulic properties for transport. And the way we want to look at that is to look at Slide No. 15 to describe the flow paths inside the containment.

This is possibly the same slide that Mr. George had earlier in the presentation. And, naturally, I have a little bit different presentation on it.

We're going to focus on the containment spray system, initially. The containment spray -- moving target -- sprays water through nozzles on the containment dome and underneath each of the principal levels of the containment.

Let's take, first, the water falling from this spray nozzle. It will tend to accumulate on the operating deck. Now, the operating deck has not joined on to the containment shell. There is approximately a six inch gap there which is designed to make the containment shell independent of the internal containment structure.

There is also a curb around the floor next to the six inch gap. So that what happened is there is a very low velocity of water flowing across the floor against the curb and so it spills over and into a waterfall going down to the basement level.

The same kind of thing happens when spraying water from the intermediate levels. It falls on the appropriate floor, flows toward the edge, and flows over. In these cases, then, the velocity of water across the floor is below the velocity required to transport paint particles of a critical size. And, therefore, the paint on these levels does not reach the basic level.

Now, we've got to look at two other things. One is the basement level -- it has its own spray, and these sprays are joined by water that came through the RHR system. Post DBA, water from the RHR system will flow through the -- and flow into the floor of a steam generator component. So, that water will join the spray water. It can't be seen on this slide, but there are obviously passageways in the steam generator component. The water has to flow around -- toward the sump.

I'd like to show that in a little more detail for that flow is important, on Slide No. 17. The basement floor, then, is the one that merits the most examination. What -- water comes down the -- water comes out of the steam generator compartments and we assume that the break -- steam generator compartments -- number four or number one because those are the compartments closest to the sump.

Water flows out of the compartments this way toward the sump. Water flows down the -- and flows around this -- toward the sump and water flows from the spray nozzles here into the pool at the bottom and flows around toward the sump.

Now, what this graph shows -- is areas of -- vessel velocity for transport of the paint particle. And as you can see in most areas, the velocity is low, the critical velocity. So, we are able to exclude, again, any paint particle that fell from this area and approximately from this area, ever reaching the sump.

Now, perhaps, I should explain further, that consider -- like this, where the velocity is above the critical velocity, what happens if paint particle -- but then settles out? Yes, sir?

MR. SERKIZ: You referred several times to the critical or essential velocity.

MR. PURDY: Yes.

MR. SERKIZ: I'm familiar with the analysis you referenced. Can you assign a number to that in your terminology in terms of feet per second or will you later?

MR. PURDY: I had not intended to. My recollection is that it's .023 feet per second.

MR. SERKIZ: I'll return to that later. Thank you.

MR. PURDY: Okay. Yes.

MR. DIAB: Critical -- being what --

MR. PURDY: 118. According to -- well, we have that in our tabulation of the report, do we

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not?

UNIDENTIFIED SPEAKER: Yes.

MR. PURDY: Okay. Now, there are a couple of areas where we considered that this use of overall velocity is not appropriate. Again, being conservative, if we do that DBA, say -- compartment No. 4, there is initially going to be very high flow rates in this area. Obviously, because the DBA is there and we get all this steam and water -- from the reactor cooling system. So that while we may say that this area is -- because post accident are low, at the moment of the accident, there are very high velocities occurring to that containment, to that area.

We. therefore, said that we will consider that all paints in those two steam generator compartments is transported to sump. Furthermore, let us consider an area like this one right here. We're going to have water flowing out of the steam generator compartment and as it happens, it flows down a set of steps about four feet high into into this area. Assuming that the average velocity is low enough to do that paint transport, seem to me ought to be not considered here. And we really assume that starting from here, that's steam generator compartment No. 4 and steam generator compartment No. 1, that any paint

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particle that reach this point, say, could also get to the immediate area of the sump, even though, analytically, formulas say that that's not clearly the case.

Now, returning to Slide No. 13 for a moment, --

(END OF TAPE).

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MR. BURWELL: May I look just a minute? Before you get on with flow, you indicated earlier that the upper floors had a 6 inch curve on them, I believe. No, it is a 6 inch gap but they do have a curve.

MR. PURDY: A 6 inch gap and a curve that's-

MR. BURWELL: Then you got - right.

MR. PURDY: Right.

MR. BURWELL: And the flow off of that floor would be over the curve.

MR. PURDY: Yes.

MR. BURWELL: Do the stairwells have a curve? I don't seem to remember the stairwells having a curve. I don't think it would effect your conclusion but I would like to understand what the situation is.

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MR. PURDY: Well, we did go out and look at that last Saturday and, actually, a stairwell is a square cutout in the contained floor. Three sides have curves and the fourth side, probably the way you remembered it, because if the curve were there, you would have to step over it, does not have a curve. So, there is approximately 6 linear feet of non-curved area per floor and there are two stairwells.

Of course, there are approximately 135 high and a little more area that's curved. The periphery is curved and that is 135 feet diameter times pi, so it is, what, 135 times three, approximately 400 feet of curved area on the floor.

Okay. So, having estimated that the paint that could be transported through this sumps is represented by the total paint surface within either compartment, one and four, and the entire liner plate, up to the spring line from 300 degrees over, I think we said, to 110 degrees. 110 degrees would have to be about this area here.

We then compared the total amount of paint against the amount required at 50 percent low blockage. And, what we found was that there is 114,000 square feet of paint that could be transported to the sump against 117,000 square feet -- the 50 percent low blockage.

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But, of course, at first we think we are extremely conservative in estimating the amount of paint that would be transported to the sump. And, secondly, we know that the screens themselves have a great deal of reserve capacity beyond the 50 percent criteria in new Reg. 1.82.

We therefore feel comfortable by saying that failure of paint within the container will not adversely effect the performance of the ECCS systems.

MR. BURWELL: May I interject that the degree used by Mr. Purdy in describing the areas of containment in which the paint would be subject to movement to the sump identified on slide 17.

MR. IPPOLITO: Since it appears that the amount of paint that can migrate to sumps is very important to your analysis, I would like to ask a question if one assumes maximum flow out of the nossels, take the upper level -- , and we know we have the stairwell, is the amount of water that falls on the floor, with this hole in the floor, will the curves ever be effected in retaining the particle sizes that you had indicated earlier? You said the flow over the curve-

MR. PURDY: I can see your point. I can't analytically answer that question at this time. I can give you only some indication because the uncurved area is such a very small fraction of the total area available for flow off the floor. That's about all I can tell you at this moment.

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MR. IPPOLITO: You understand what I am saying. Does the curve perform the filtering that you expected it to:

MR. PURDY: It is not a filtering function.

MR. IPPOLITO: Well, I mean it retains, I guess that is the same difference.

MR. PURDY: No, the flow,- it slows down the flow,-

it can't carry the-

MR. IOTTI: No. The other significant part is that the average velocity on the flow permits most of the stuff to settle on the floor and only whatever paint falls in the immediate vicinity of where the opening for the stairwell, that's where you might have a concern as to whether the curve -- the filter. But, if you are far enough away and the velocities are very low far enough away, it isn't going to get in that vicinity so that those two would back up --

MR. SERKIZ: Al Serkiz, and since you brought up this point, what are the characteristic velocities that you calculate far away and in the vicinity of the stairwell?

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MR. PURDY: -- can you answer that question?

MR. SERKIZ: I'll raise that question maybe not now, but I will come back to that because that goes back to Tom's question. Tom's question which started,- but the answer can be addressed, I would prefer to see the answer addressed in terms of calculated velocity.

MR. PURDY: We have calculated velocities from the report.

MR. SERKIZ: I understand what you are saying. I didn't see in your report, however, calculated velocities on the upper floor levels.

MR. PURDY: No, we did not list this as a perameter. We can do so in an amendment or elaboration report which will be submitted in two weeks.

MR. SERKIZ: Let me come back to that question later. To me it would make more sense -

MR. PURDY: When are you going to come back to it?

MR. SERKIZ: Well, Tom raised the question. I am suggesting that we address, instead of exceeding threshholds and critical values, we talk in specific numbers.

Mr. PURDY: Yes.

MR. SERKIZ: But, you have a presentation, I would like you to go through your presentation and we will come back and go through your slides and ask the same question.

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MR PURDY: Okay.

MR. MATHEWS: Just a question of clarification, is 114,000 square feel of paint free that you mentioned, that's primarily contributed from that lower level and from the region -- . This analysis has assumed -- level above became -- --

MR. PURDY: Well, it is almost correct. You are right. There is no contribution of paint from the floor levels above the basement level. There is a contribution from the liner up to the screen line because we assume that it can fall straight down the 6 inch gap.

MR. MATHEWS: Okay, thank you.

MR. DIAB: -- (Too Far From Microphone)

MR. PURDY: Okay, what we assume is that all the paint particles come off as 1/8 inch, as one uniform size because we think that is the most conservative way to estimate the transportation of paint to the sumps. Smaller particles will be more easily transported, that will pass through the screen and pass through the entire system. Larger particles will be less easily transported and you get into a more elaborate calculation if you -- how to estimate the larger sizes.

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I should also mention that we have looked at paint failure mechanisms to some extent and the Phynol line 305 will fail as flakes of various sizes depending on circumstances. The under coat of Carbo-zync 11 fails as a powder and, properly speaking, should not be included in the analysis, but for the sake of conservative -- we included the volume of carbo-zync 11 as well as the phynol line 305 and the concret codes.

MR. IPPOLITO: -- -- in the form of a 1/8 inch flake?

MR. PURDY: Okay. Correct.

MR. IPPOLITO: And then, take that and assume -- --

MR. PURDY: No, don't assume the triangular shape. We calculate the triangular shape in accordance of the procedures of the new Reg CR 2791. There is an angle of repose given in there for granular material. Well, it is not given in there quite, but procedures for calculating the angle of repose and the packing factions of the pile are given in New Reg 27,- CR 2791 and that is what we used.

MR. IPPOLITO: Okay, I guess I am not very familiar with -- -- and the density of the particles?

MR. PURDY: It is based on the density,- I can't say that it is based on the drag force because I don't think an angle in repose is based on drag force. It is a static phenomenon, not a dynamic phenomenon.

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MR. IOTTI: It is also based on the -- effect as you accumulate and the velocity progresses and gets higher -- --

MR. PURDY: You had a question still?

MR. SERKIZ: I just want to be sure I am staying in the correct train of thought with you, and that is you made the point on slide 17 that when you did make this assumption between 110 degrees and 300 degrees, your calculation was, I believe 114 square feet.

MR. PURDY: 114,000 square feet.

MR. SERKIZ: I'm sorry. 114,000, pardon me. And, you made the comparison to 117,000 square feet and 50 percent blockage and the clarification, or whatever way to phrase it, is,- this is strictly paint degree.

MR. PURDY: The 50 percent blockage -

MR. SERKIZ: The 114,000 -

MR. PURDY: Let me finish this. 50 percent flow blockage, 117,000 square feet, 114,000 square feet are all related only to paint blockage. We separately did the insulation blockage and we found that it was very small in comparison with the paint.

MR. SERKIZ: I will come back to that later but as you verified that for me, thank you.

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MR. PURDY: Yes?

MR. BURWELL: You also indicated that all of the paint in the compartment was assumed to be failed.

MR. PURDY: Correct.

MR. BURWELL: That is all the way up to the top floor?

MR. PURDY: Yes. Up to the top.

MR. BURWELL: Okay, that was the question. Thank you.

MR. PURDY: Okay, can we proceed then?

MR. BURWELL: Yes.

MR. PURDY: I would like to introduce Mr. Bob Iotti of EBASCO who will describe the study that he has done.

MR. IOTTI: Good morning. My name is Robert Iotti and I am with EBASCO Services and at the beginning of this year EBASCO was asked by PEPCO to perform an independent, but bounding study, for a study that was also ongoing at the time as being reported by Gibbs and Hill.

In my first slide, which I refer to slide 18, I would like to dwell a little on the words, "Independent and bounding". We know it has to be independent. We weren't quite sure what bounding meant, and we had not seen, nor had talked to Gibbs and Hill, so we had no idea what it would be doing. However, it was left to me to decide how to proceed.

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I knew about the regulatory documents and some of the new reg documents that are being referred to before and I opted to follow an approach that would not be not necessarily elegant but would be so bounding that if the answer turned out to be similar to what Gibbs and Hill predicted, no one could challenge the ultimate conclusion.

The reason I chose an inelegant approach is that there are things that cannot be,- are really not amenable to theoretical calculations. And, in light of some of the questions that have come up this morning, perhaps it was a good choice.

I reiterate again, we had no knowledge of the Gibbs and Hill approach untill all of the studies were completed. So, I will be presenting material this morning that doesn't appear in our summary report because this is material that I felt needed to be addressed for completion sake after I realized what Gibbs and Hill had done.

Naturally, since it was not told to us how to proceed, our approach turned out to be significantly different from what Gibbs and Hill had done and I also tried to take an approach that would recognize that the various new reg document were in existance and that, clearly, the western Canada full scale test had been performed before we had the knowledge of that data, but it would not necessarily rely on what was done. It would be totally independent from what was done before.

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I will tell you the conclusion and then I will walk you through each of the steps that led us to the conclusion. Our conclusion, ultimately, is that the Gibbs and Hill conclusion of the potential failure of paint incontainment would have no consequence, adverse consequence on the performance of the ECCS sump and the plan is a correct conclusion although we arrived at the conclusion in a totally different manner.

Now, some of the assumptions that I felt should be initially made and could not be challenged and who could clearly be bounding for any study performed by Gibbs and Hill, are that all of the paint incontainments fails and it fails in flecks that are greater than 1/8 of an inch.

Now, our conclusion for an eighth of an inch being the threshhold particle size is really predicated on two factors. One, as it turns out, we also did a quick calculation to determine what could be transported using the method of new Reg CR 2791. But, in addition,

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one of the mechanisms of transportal paint into the floor of the container and near the screen was one which goes from the surface of whatever water level you have, through the water, through watever motion the fleck of paint wants to take and eventually into the screen or onto the floor.

For that particle to go through the surface of the water, the surface tension of the water must be broken by the particle. It turns out, any particle smaller than 1/8 of an inch will travel along the surface of the water and may never get down. On the other hand, particles larger than 1/8 of an inch will be arrested, have their velocity arrested and eventually start out at any angle to make their progress through water. So, the combination of these two is what brought us to examining particle flecks of 1/8 inch or larger.

In view of your question, we looked at all particle sizes, and it turned out, in our approach, it really didn't make any difference what size we assumed as long as it was larger than 1/8 inch.

The second assumption, seems to be it is very important, tnat somehow no matter where the paint fails, and this is all contained, concrete, steel, in containment, finds it way in the vicinity of the sump.

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I think this answers partly some of your questions. We don't care whether there is curve, or where the paint starts out, it gets there.

Now, once you have made those two assumptions, then you are stuck on deciding how you are going to --. There are secondary assumptions that need to be made. Secondary assumptions that we had to make is, if it gets there, how is it going to pile up and over what area will it pile up?

I will now use, this pointer, and I will be referring to slide number 20. Initially, we chose a -- that we felt was dictated by the physical appearance of the region here, the --. We visit the --, we walked the area, we looked at all the possible optical around the area. We looked at the relatively open area above the sump and we decided there was an area of approximately 1,000 square feel in the vicinity of both sumps where if all the paint wanted to go, that is where it probably would go.

Bearing in mind, that at this state, the 1,000 square feet is an assumption and we will have to justify the assumption later through some supplementary analysis, so keep it in mind.

MR. SERKIZ: Just a question. When you refer to a thousand square feet, are you talking to looking down at that, a regional area? Because there are different areas that will come into -

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MR. IOTTI: I am glad you brought that up. The thousand square feet is the plainer, looking down into the plain of the ladation 808. It is the plainer and surrounding both sumps.

MR. SERKIZ: Thank you.

MR. IOTTI: We also made additional assumptions which you may or may not find in that summary report. We assume, as it turned out, that constanant to what Gibbs and Hill assume, that you are to have both sump operating to infer from that what the maximum transport velocity would be in the vicinity of the sump. This is the lower elevation of containment. But, we,- contrary to what Gibbs and Hills has done, we then assumed that all of the paint accumulation would be against one sump. Now, clearly that is inconsistant. We assume two are operating but only one is available to accumulate paint against.

MR. IPPOLITO: Excuse me. Are you saying that you assumed that all of the paint found its way into one-

MR. IOTTI: One sump.

MR. IPPOLITO: Just one sump?

MR. IOTTI: Right, or in the area surrounding one sump. To determine whether the paint would accumulate with angular repose or accumulate horizontally in a pile, we had to select the largest velocity -- in the vicinity. In that sense we did make use of the results of the Western Canada test. The Western Canada test told us that around,- you can infer, because the test does not specifically tell you what the velocity there is. But, from all of the other information it gives you, you can infer the yield with a 50 percent blockage.

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You would have velocity in the order of .08 feet per second in the areas immediately adjacent to a sump screen if a single sump operates. Now, if you have tow operating and if you look at the specific geometry of the area applying the use of two sumps, you notice that eventually you can actually calculate double the velocity, so, you assess how the paint is accumulating, use .16 feet per second in that region near the sumps.

Now, the manner of accumulation, I essentially have already gone over it, we chose a horizontal piling because -- effect with that kind of velocity is insufficient to really bring the angle of repose that Gibbs and Hill has talked about. Furthermore, later on I will justify that the supplemental analysis backs up the assumption of horizontal piling near the sumps.

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So, again, assume, for the time being, that is an assumption made to begin this study and that later one we will attempt to justify the assumption. So we now have only two assumptions, 1,000 square feet and a horizontal piling.

The next assumption we had to make is,- yes.

MR. KUDRICK: Is that 500 per sump?

MR. IOTTI: No. Right now it is just 1,000 square feet around one sump, however it gets there.

MR. KUDRICK: One sump.

MR. IOTTI: One sump. Okay? The next assumption we have to make is, okay, if it packs horizontally, how densely will it pack? Well, the obvious assumption intially that you make is that it packs very densely. There is no water contained between paint, let me call it, peels. It is better understandable, even though they are really flecks, or they may be powder, but later on we will also give you results of different packing fraction and I will mention a separate study that we did to assess what the real packing fraction ought to be or the range or packing.

Finally, the fourth assumption, we were in a quandry whether to assume the -- conistic arbitrary blockage of that particular sump is 50 percent which was a requirement per reg. .18 revision 0, but somehow it disappears in guide 1.32 revision 1. Well, we assumed that it was.

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Bear in mind that that assumption, translated in numbers, means that we have 3,000 cubic feet of debris of some type other than paint, which is horizontally packed around that particular sump. That is 3,000 cubic feet. That is a lot more than you can conceivably see any insulation, particularly considering the double insulation of existing -- container at Comanche Peak.

So, that is the initial assumptions and secondard assumptions. Now, what were the first results? If you buy all those assumptions, if you have all of the containment piled up, and this is slide 21, and again, I will ask you to wait until I later on confirm that 1,000 square feet wasn't such a bad assumption to start with, that 50 percent of the screen is assumed blocked but whatever reason you wish, and it is horizontal blockage, that all of the containment paint accumulates horizontally on top of the already horizontal debris and the packing fraction of 1, you end up with a blocked area of the screen which is equal to 66.8 percent.

And, from the Western Canada sgudy, that particular blockage is acceptable to us. Now, turning to slide number 22, I want to refer to mine, because there are a few typos that I need to correct as I go along and I will refer to them as I get to those slides.

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MR. LI: How is your volume of that debris -- --

MR. IOTTI: We use the density of 80 pound mass per cubic foot and multipy the total quantity of the paint in containment which happens to be ,- well, we assumed it would be 1,060 cubic feet and that was an erroneous assumption. As it turned out, the actual quantity of total paint in containment turned out to be 1180.

MR. LEVINE: No. We used the calculation,- was 1050 and the actual value is more like 1160.

MR. IOTTA: So, we took the total volume of containment and packed it at a density of 80 pounds per cubic foot over an area of 1,000 square feet.

Now, let me go over some of these assumptions of the packing because the packing of one is clearly non-conservative. We evaluated by a methodology which is different that what is employed in New Reg. CR2791. What is the most likely packing fraction, if you have peels, you know, layers of paint, once starts to -- over the other, the two mechanisms that influence the packing ratio are the hydrostatic pressure, the weight of each consecutive peel layer and the adhesion between the water and the paint layer.

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That water film between two paint layers has to be squeezed out in order for the paint layers to get closer and closer together. Of course, like any of those studies, you can only come up with ranges of packing fractions and never produce it exactly, but we calculated at a reasonable packing fraction at between .39 and .76 which seems to confirm the .5 that Gibbs and Hill has used.

On the other hand, we saw, because of our assumptions, that are very conservative, we would be allowed to use the higher range and we chose .75. And, the reason we chose that range is that, as you get to lower and lower packing fractions, the assumption that no flow can go through your bed become more and more reasonable. And so, the additional assumption we made is that, regardless of the packing fraction of .75 percent, to whatever height the pile would be stacked, no flow would pass through that height into the sump.

Now, if you make the assumption, all the prior assumptions, your packing fraction being .75, then the percentage blockage of the screen turns out to be 72.3 percent which is, again, acceptable when you look at the - yes?

MR. SERKIZ: Why do you call the 50 percent malamechanistic blockage at the bottom when you say it several times that it was an assumption in your last bullentin?

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MR. IOTTI: It is a non-mechanistic. It is a typo.

MR. SERKIZ: It is a non-mechanistic.

MR. IOTTI: Non-mechanistic, I'm sorry.

MR. SERKIZ: Thank you.

MR. IOTTI: If you please rely slide 22 to reflect that the 50 percent is a non-mechanistic. Now, let me get back to some of the justification of the assumptions and now I am going to go into slide 23.

I would just like to dwell for a second on the assumption of the non-mechanistic 50 percent blockage. We assume that, on the other hand, we don't think it is warranted, I don't think anybody can quarrel with it's conservatism.

MR. SERKIS: I would question that and your basis for saying that it can't be quarreled with, the 50 percent number, whatever way you want to phrase it.

MR. IOTTI: Okay. What would be the mechanism to bring in a 50 percent blockage?

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MR. SERKIS: You made the point that it is unrealistic, you used different terminology and your basis for saying that the 50 percent, in any way you want to describe it, is real or unreal. You assumed, and I don't quarrel with your assumption. I understand the- but you made the point several times, and other people, and I am just curious, is there two ways to look at the problem?

MR. IOTTI: My understanding as to why that number was initially assumed way back when the first regulation came out, is that that was the number that would account for -- suchas insulation being dislodged from its normal place and transported eventually to the screen. Now, when you have a containment and you perform the type of study that would show, in fact, as the Gibbs and Hill study has done, that that mechanism for transport at the top of insulation existing in the containment is not one that would lead you to this kind of blockage factors. Then, I question whether in fact one should assume that --

MR. SERKIZ: Then, I would question either of the analysis and I would bring, for the record, that there is a contactor report that was published in January, new Reg/CR3616 that does contain transport and screen blockage characteristics that reflect the metalic insulation materials which, in terms of geometric size and shape, do bear some kinship which do not support the conclusion reached in the Gibbs and Hill report that the material will not transport until velocities are greater than 2 feet per second or there about, are reached.

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MR. IOTTI: This is the one that was done around .2 or so?

MR. SERKIZ: That is correct.

MR. IOTTI: We still don't have in the vicinity of that sump velocity in essense of .2. So, it may transport in certain areas of containment but I still don't think it would get that near the sumps.

MR. SERKIZ: Well, I would like to come back later and hear your analysis of velocities in a vicinity of the sump which I think is a key factor in making some determination.

MR. IOTTI: Okay. It is your understanding, however, that we did not do -- kind of elegant analysis that they did in terms of philosphy.

MR. SERKIZ: I just have heard the point made several times that no insulation can transport and this is why I kept asking if the preceding speaker was referring to paint and that clarification was made.

MR. PURDY: As a clarification --

MR. SERKIZ: And you reviewed the results in new reg CR3616 and still maintain that conclusion?

MR. PURDY; -- had nothing to do -

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MR. SERKIZ: Okay. Thank you.

MR. IOTTI: We assumed it anyhow and maybe I should have never made the statement - I am glad that we assumed it.

Now, let me get back to the second assumption. That will be an assumed horizontal accumulation. The primary reason why we assumed that horizontal accumulation was a reasonable assumption to be made in the area near the sump as we had used a velocity which was representative of really both sump operating and that velocity was still below .2 at least by our own calculations, and furthermore, we knew that we were accumulating against a single sump so the velocity -- would have been,- was really lowered to make those assumptions in the system.

But, we also performed the supplementary study to determine whether that assumption, and together, the assumption of the 1,000 square feet really held water. Now, let me skip to slide number 28 just for illustration purposes because it will help me show you what we did. I will use this later on also.

But, there could be paint on the floor but there is also a likelihood that paint coming down from a -- floor driven by the sprays will reach the surface of the water. This is not a very clear, but assume that this is the surface of the water, okay, and that this is a paint fleck that just has fallen down either driven by spray or through the side of the containment and washed down to the surface of the water. Now, once its velocity is assumed to be arrested here, and then the paint fleck can start at any angle -- is subject to its own weight and you can think of it as almost an air-foil and we did this calculation in a variety of equations, but it turned out that the most conservative and the one that made it go further was the air-foil theory.

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And also the general drift philosophy that pushes it toward the screen. What we tried to analyze is as they fall into containment, the thing somehow gets into this vicinity and it is in this form, what would be the area within which it would fall? It turns out, that because of the fairly substantial specific gravity of this paint fleck, the paint flect almost randomly can sail in any direction.

In other words, the drfit velocity has relatively little affect. It is not totally random. There is a preferential forward motion. In essense, if you have anything fall within, let's say, roughly 10 feet distance from here, if you draw a verticle plane from each side of the sump screen, and then you draw a line out ten feet. Okay. Now, any paint within that area will fall, let's say, half within the 10 feet and half outside. It turns out, by 12 feet really. But, you end up with an area measured out in plane, a projected area and plane outside from the screen of about 24 feet within which it is logical to assume somehow the paint finds its way there. That is where it would settle and since it settles kind of randomly, it will settle horizontally because there is no mechanism to draw it in and change that horizontal accumulation.

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Now, if you calculate the 24 feet area all around the one sump, you end up with approximately 922 square feet of area, 922 is close enough to 1,000 for this type of a study.

We felt that kind of vindicated our original judgement that 1,000 square feet is not a bad idea. Now, we also redid the calculation for 922. So, now I can return to the slide number 24, which questions this assumption of 1,000 square feet.

In this particular supplementary study, and this is incorrect, it is correct in the plain. In other words, if this is the area of the bottom floor, away from the screen that could be occupied by the paint, at the surface of the pool we should be -- --
So, for clarity correct that --. Water surface is 13.

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Now, this again, is all of the paint in containment.

MR. SERKIZ: The whole thing.

MR. IOTTI: The whole thing.

MR. SERKIZ: Okay.

MR. IOTTI: Going on to slide 25, there are a few other effects the -- talked about, that we started worrying about.

What about the paint that happens to be sitting or falling out directly from overhead and is falling on top of the screen or more importantly, the one that misses the top of the screen which is a solid plate, and falls in the immediate vicinity of the screen, the verticle screen? Of course, there, the velocities, however low, will make it drift and it takes a certain finite amount of time for the particle flect to fall to the bottom, and during that time it could drift into the screen.

Well, if it is larger than 1/8 of an inch, it can be brought against the screen, stick to it and we don't know what to do after that. We assume it stays stuck. Maybe it will or maybe it won't, but we made the assumption that whatever stuck vertically to the screen would remain there.

So, we then performed, again, an inelegant analysis

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to determine what would happen to the paint that falls vertically down within a distance of 4 ½ inches, which are known to be the critical distance, from the vertical plain of the screen up. And, we assumed that whatever paint would fall in that category, would, in fact, be brought against the screen and vertically stick to it.

As it turns out, at the time we did this calculation we had not recognized two things. One is that the top plate actually extends out 6 inches along the long side, and three inches along the short side of the screen. So, we still left it at 4½ inches because there is a certain effect that whatever paint is accumulated on the top of that top plate, the edges may be drawn in. So, We felt that we ought to stick to the assumption that there was no plate overhang.

Let me anticipate your next question. I will address similar phenomenon later on because this only addressed part of the problem. But, I am thinking through the stages one at a time.

MR. MATHEWS: Would you clarify again the basis for the 4½ inches. Is this simply a distance -

MR. IOTTI: It is a distance away that if you take the -- velocity, when the -- falls through,the time that it takes to fall through, essentially permits it to be drifted against the screen.

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MR. MATHEWS: Thank you.

MR. IOTTI: Okay. Now, bear in mind that this is only a partial answer, but it is the answer as we no to that point in time. Let me go on then to the result of the supplemental analysis which now has the 50 percent non-mechanistic blockage which gives you a height of about 3.125 feet along the screen, 1,050 cubic feet of paint within the 922 square feet by now which gives me a height of 1.14 feet, and this 4.2 inches of,- this is the screen surface height which is blocked by all of the paint that falls within this 4.2 inches and sticks vertically.

So, imagine you have this horizontal pile and then on top of this horizontal pile you now have a vertical layer of paint, single layer,- here we are totally inelegant but arbitrarily conservative, hopefully, which gives me a blockage then of 87 percent.

Now, we are approaching then the 90 plus figures that Western Canada has seen in its test. On the other hand, we believe there is ample margine still with this particular blockage. Let's see, again correction. Just for the sake of you understanding what I meant by 24 feet, this is not the water surface 24 feet, this is the projected area at the bottom. Yes?

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MR. SERKIZ: I just want to be sure I did interpret you correctly. The 1.14 feet is derived from this other analysis looking down and this packing occurred?

MR. IOTTI: Yes.

MR. SERKIZ: And as so, that comes up to some level and that is your 1.14 feet?

MR. IOTTI: Yes.

MR. SERKIZ: And then you do this other analysis which is a capture velocity type of an analysis within the -

MR. IOTTI: And it gives you another 1.09.

MR. SERKIZ: Okay. Thank you.

MR. IOTTI: Okay. Now, let me go on to slide number 27. And let me summarize what I believe to be the conservatism that were attendant to our analysis. And then, also refer to a possible other consideration so far hasn't been talked about.

One, is that we assumed that all the point in containment, first of all, failed, and second, that somehow it got into the vicinity of the sump regardless of how. This should be, no, as opposed to NI. There would be no flow to whatever accumulation or packing in the vicinity of the sump.

We further assume, again, a 50 percent sump wihin SUMP blockage, arbitrary, and whatever sticks vertically to the screen stays there and doesn't come off. We think some unknown fraction will come off but we cannot quantify it. That is why we made that assumption.

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Furthermore, we assume a single layer packing for the vertical sticking. In other words, there is no duplication. A fleck will not come in behind another fleck. We think all of those assumption together reasonably bound the problem. However, there is one consideration that has not been addressed. And, after having seen the Gibbs and Hill report, I personally felt, should be addressed, so, let me get back to the other picture that I once before showed you and I refer to this affect as the "flutter", or "Air-foil" or "Butterfly" affect of a paint flect falling through water.

The theoretical analysis of what happens to a paint fleck falling through water on its own gravity, it is an impossible task so we had to make certain assumptions.

One assumption that we looked at it as an air foil. Another assumption is we looked at it as a random tumbling mode type draft affect and throughout those analysis, we also had the drift velocity toward the screen.

We looked at it randomly, essentially like a Monte Carlo process. If you look at this as an air foil, the air foil theory gives us the largest distance traveled by the flecks on the surface of the water. If this paint fleck starts out its fall will be retarded by drag, but lift will move it toward the side and it can start out, of course, in the direction of the drift velocity or can start out in the opposite direction, or it can start out at any -- or angle.

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If it drifts out far enough, you know what happens. Eventually the angle of attaching until it stalls. The moment it stalls, it goes off in some other direction. However, another paint fleck from some other place has just reached the same point at the same time and it continues the trajectory of the first paint fleck had.

So, all we know, we think you can examine the paint fleck and assume it really behaves and goes that way. Now, when you made those assumptions, then you of course, have to live. If you preach by the sword, you die by the sword. We started looking, would we be able to accept all of the containment paint getting to that surface?

It turns out of course the area of the pool that is effected, is still about this 10 to 12 feet. Within that distance you can stick vertically to the screen. Outside of that distance you would not know it.

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So, we made,- let me list the assumptions that we made in this, socalled, "Flutter analysis". One, that the paint, called it flake, it should be fleck, starts at the water surface with zero velocity, that the surface tension is sufficient to arrest it but it will not stop it. Eventually it will go down at whatever angle it wants to.

Secondly, that it starts traveling through the water with arbitrary, vertical and -- angle so you have to repeat that study for a variety of angles and then come up with average values.

Thirdly, that we follow this average paint fleck, we used a drift velocity of .16 which is characteristic at this stage for both sump operating, at least as we infer it from the Western Canada test, but in reality, with a single sump being accumulated against, that velocity would be lower. On the other hand, we recognize that has the -- get higher the velocity would get progressively higher so the two are compensitory effect and we chose alway .16.

The density of this fleck was assumed to be 80 pounds per cubic foot. In reality the minimum densities are apt to be about 90 and there are some that are about 200. And, of course, the larger the density, the shorter distance it will travel. Although, surprisingly, density doesn't have a profound effect because it is the angle of attack that has to be --

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This is like an air foil. By the same token, let me dwell on that point. The gentleman is gone, one of the consequences of this type of study is that the size of the fleck really cancels out of all of the equations. There is very little difference between a large fleck and a small fleck until you get below an 1/8 inch, in which case, the fleck won't go through the water cause surface tension will arrest it.

We assume, of course, a water level of 9.5 feet which is the highest and, again, once a flake gets to the screen and blocks that little area vertically, no other fleck gets behind it so it is, again, in a single layer.

That leads me to my last slide, slide 30 and I will present two different type of results. One, assuming that there would no debris on the floor, we gave up on the 50 percent mechanistic assumption, for the first study. We reinstated it in the second part of the study.

Let me point out that the first bullet has a typo. The first figure should not be 88 percent, it should be 80 percent no considering all containment paint within section next to the sump.

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Now, we were in a little bit of a quandry for how to consider the paint that gets to the surface of the water from the wash down affect of containment. In other words, the sprays would wash out all of the paint from the upper floors, mostly through the containment liner.

Now, we are not sure that the assumption that the paint fleck will be arrested at the water surface is, in fact, correct, when you have spray driving it. And also primary angle will be almost at 90 degrees at the water surface. So, we made the study under both assumptions. One, that the angle would again start out at any angle with zero velocity, and the other one that would assume that whatever paint comes through the liner, as a wash down, would really be driven to the floor.

We think that a combination of these two studies bounds what might really be happening. For the first study we were only considering the paint that is within the 10 foot surface area that could logically fall within that area and eventually go vertically to the screen. Plus, the portion of the liner that just is in that floor, the -- floor. We ended up with a blockage of 80 percent of the screen.

If you assume that the total containment paint, from the very top,is washed down, then what happens is that the side of the sump that is next to the containment gets completely blocked and the remainder of course follows the same type logic as calculated from our analysis and you go from 80 percent blockage to 88 percent blockage.

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Now, what happens if we assume that we have this 50 percent debris on the floor? It turns out that in either case you end up with 93 percent blockage of the screen. Now, that is pushing it. On the other hand, correct me if I am wrong, 93 was what western Canada also looked at. So, we feel that there is adequate margin now. We did a calculation extrapulated from the

Western Canada study as to what would happen to us if we had 93 percent blockage. We concluded that we, our head loss -- would be approximately 2 feet.

Now, we had marginal base. I agree the mechanism for that head loss is probably slightly different now that you have all of this stuff piled up as opposed to just having a vertical plate blocking it.

On the other hand, what makes me feel comfortable is that we have a lot of margin. Even it were 3 feet or 4 feet, we would still have margin.

Well, that concludes the presentation of the EBASCO Bounding study and if there is no question I would like to turn this over - Yes sir.

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UNIDENIFIED: Did you consider the --

MR. IOTTI: You mean on the heat exchanger?

UNIDENTIFIED: Yes.

MR. IOTTI: I looked at the density. The answer to your question is, not directly. It will have some effect. You recognize that for the RHR heat exchanger size you have already assumed the following factor which is -- the heat transfer coefficient by roughly 20 percent. Okay. And I would assume that this would be part of that bounding factor even though that is not specifically addressed which is an arbitrary assumption of the duration.

The type of densities that you would have in the water would be due to the parts per million or part per thousand particals, would be due to whatever particals exist which are below the 1/8 inch size. Specifically the zinc and organic primer which is like specific gravity floor.

Even if you assumed that all of the zinc somehow or other comes down as powder and it is mixed in with the water, the density of that zinc is only .3 pounds per cubic foot. It is not that much. In other words, it will stay disbursed. We haven't analyzed what would happen to the suspension and whether it would be continued to be carried or settle out.

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I don't have a final answer to your question. I could make a dissertation of one of my people available to you. He actually did the -- studies and he showed that if the particles are small enough and stay suspended, they will stay suspended and only will eclomerate in that area which would not be -

UNIDENTIFIED: --

MR. IOTTI: No. Only in the dead areas of the heat exchanger. It would not be accumulated, for instance, in the tube where you have velocity, if it is small enough. If it becomes large enough so that it can have that affect, it will attempt to settle out and at the low velocity, most of it will settle out. Remember, I told you all of the zinc is .3 -- be as powder carried in the water. I am giving you a lame duck answer but it is the best answer I have.

UNIDENTIFIED: Your study does not consider -

MR. IOTTI: No.

MR. GEORGE: Okay. Thank you Mr. Iotti and Mr. Purdy for your presentations and let me reiterate, we are here today and tomorrow and whenever. You have inquired what is the -- issue and answer any questions that come out of your evaluation and our discussions.

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So, at this point, I would like to discuss with you how we propose to proceed in this matter of coatings inside the container, and essentially, the application practices remain unchanged. We certainly will continue coatings which were qualified materials which Mr. Purdy discussed with you and we will certainly continue using qualified applicators in using the approved applications procedures that exist.

The difference in the -- determination of acceptability be accomplished but not under the -- 10 CFR50, appendix B or reg guide 144. We would propose to use in process verification by -- on the applicators. -- documentation maintain the surface preparation, primer and finish coat application, satisfied the coating specifications --

I might expand on those two points a bit. What they are really saying, that we would document the acceptability of -- -- surface preparation and applications of the coating systems and would verify cleanliness of steel and concrete, verify the -- profile and --.

We would document that the proper materials are being used and that they are being mixed in the proper proportions. We document the -- and the primer and the finish coat and we would verify the coating system secured and would verify finish coat continuity.

That's the details of what those two quotes mean.

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We would continue to monitor craft activity by our engineering to insure that the objective of an acceptable finished product would be desired, corrosion protection and conduct decontamination processes are there.

Now, we have submitted a draft FSAR amendment to the staff, if approved they will [illegible]t -- in this manner.

(End of tape)

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MR. IPPOLITO: Okay, I want to make some statements. I hope you -- and you probably do appreciate the fact that under short notice the staff was able to look at -- and I want to emphasize look, not study -- the documents that you gave us I guess Monday, I guess.

And I personally want to thank the staff for coming to this meeting prepared under such short notice and I, as Comanche Peak project director, appreciate that.

And I think that some of the questions you're going to hear probably are the result of not having a whole lot of time to, you know, study in detail the material you have provided us.

So I think in lieu of it, I'd like to have you bear with us and I would say that all of the questions you are here -- you might hear shortly may not be all of them, as these type of things go.

And I cannot give you a date at this time as to when these people can complete their review and come up with another set of questions. It may require another meeting. I'm not sure.

I think with that introduction, staff, do we have questions? Al, do you want to start off?

MR. SERKIZ: What choice do I have?

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I'm sitting next to you. Well, let me at the onset make the point that I did have a short period of time to go through these documents and I'd like to be complimentary to everybody for the amount of work that was put in in getting them together.

Let me speak to an opening remark that was made by Mr. Fikar, and that is I think the safety issue that we're concerned about is whether the -- sump is going to be adversely affected or, to put it another way, are you going to have adequate emthiasache margin (phonetic).

And it's reall_ from that viewpoint that I looked at the documentation provided. I would also make another point thar I looked at the Gibbs and Hill report and I set it down and I looked at the EBASCO report.

And some of my comments or questions may have some discontinuity but I'm always trying to come back to the central question is, in my mind, if you are looking at emthiasache margin and if you are postulating both paint debris and insulation debris, then that's where I'm trying to draw my questions to eventually.

So maybe I can be specific now and throw out some general comments, and take them as, I hope,

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constructive comments because they're intended to be. And I'll speak to the Gibbs and Hill report first. It's up to you if you want to use those.

MR. BURWELL: Mr. Serkiz has prepared some notes which he will be talking from. Why don't I -- I have about 12, 15 copies here -- why don't I ask the court reporter to bind this into the transcript and then I will throw these out on the table for those of you who would like --

MR. SERKIZ: Okay, I guess when I started my review, I started with the Gibbs and Hill report and I guess I proceed down this path. I'll make some general comments.

I think the evaluation that's presented in the Gibbs and Hill report is based on documents and information superseded or updated. That's my terminology.

And my reason for stating that principally is the report I referred to previously, and that is NUREG/CR -- what was the number on it? -- yeah, 3616, okay, is a document that is in the public domain, available to anybody, and that particular document does present the characteristics as experimentally determined in the tests at Alden on reflective metallic insulation materials.

And based on the findings in NUREG/CR 3616, as I'll go on -- as I get into these points further, the conclusions reached are, or at least presented in the Gibbs and Hill report, are not supported or really contradictory to these findings, and that's the basis for item 2.

My terminology I'm stating. These things were written yesterday and put through the typewriter, so you have my comments written down. The documents that I would term are current and I would bring to your attention would be the documents listed here under item 2, namely NUREG/CR-2982 which is pertinent to the Gibbs and Hill report and that you do talk about some fibrous materials.

The NUREG/CR-3616 is pertinent because it deals specifically with the reflective metallic insulations and the tests here were run, as I indicated, in response to public comments received, and if the material is free or the foils are free, this was the reason for the types of tests in here, we find that transport of metallic type materials can occur at low velocity levels in the order of two-tenths to three-tenths of a foot per second.

I would recommend, you know, that whoever has an involvement in preparation of this review it and utilize it as you see fit in your re-evaluation and analysis. I would like to dwell for a moment or two on NUREG/CR-2791 which was put out in September of '82.

It's a methodology report and it was the best cut we had at methodologies. Unfortunately, even at that time, we recognized the sparsity of experimental data to back some of this up, so used those methodologies as appropriate but fold into them this additional i· rmation.

From what I've heard, and particularly the analysis comments on the slides that you had, Mr. Iotti, I would suggest that everybody that's going to be involved in looking at this look at it because I think there's some applicable information to either support or utilize or whatever the correct term is.

There's another document that you may want to look at and utilize and that's NUREG/CR-3394 which was a probablistic assessment of the sump blockage and it was really directed at another effort on A-43, or USI A-43, but I think it's germane to this particular problem, and that is if you are looking at insulation debris, we found by going through 232 or 260 some odd breaks that the break size and target combinations that would give you severe blockage, okay, or total blockage were driven principally by the primary coolant system piping components and lower portions of the steam generator, and that's elaborated.

But again, that report -- since in the Gibbs and Hill report, you are mixing both insulation and paint, I just bring that to your attention. Okay.

MR. IOTTI: The NUREG/CR-3394, I'm not familiar with it but I have a strong suspicion -- is this the same thing as the Burns and Rose study that was initially published as a draft and eventually -- is that being turned into the NUREG/CR?

MR. SERKIZ: Well --

MR. IOTTI: The one that examined all the breaks and all of the different --

MR. SERKIZ: It was -- for the record, it wasn't -- it wasn't published as a draft but it was published in two volumes, and that's this report here. And, of course, the second volume contains all the computer printout of all the numbers.

My only reason for bringing it up here is that if you are analyzing this problem as a sump blockage problem, which I gather you are, then this report has applicability that you may want to, may not want to use, okay. No more than that.

The questions I have and -- well, maybe I would suggest that rather than try to get on-the-spot answers, use this paper as a working paper. These people may want to respond formally.

The water velocities and the calculations that you did to come up with velocities in your containment, and I refer to your Table 622, do have calculational uncertainties and maybe you can answer the question here, but what are the uncertainties because there are uncertainties when you put together flow resistances or whatever you want and what would that effect be on the velocities that you calculate?

And my reason for asking that question simply is the principal thrust of your report is if the velocities are below or in a certain range, certain things are concluded, okay.

My question simply is what are the uncertainties and, given those uncertainties, what would be the variation in flow velocities? Calculated?

MR. PURDY: Do you want us to talk about that now?

MR. SERKIZ: If you want to, fine. If we want to go through and come back, how do you want to do it gentlemen?

MR. GEORGE: I would prefer to --.

MR. FIKAR: Yeah, I think we need to take this into consideration and think on it and then get back with you. I think -- it wouldn't be very effective. Unless we can answer them yes, no, I think we need to listen to what you said and we'll get back to you right quick.

MR. SERKIZ: Well, my reason -- perhaps trying to clarify further, sometimes it's difficult to read between the lines of where the party was coming from. My question fundamentally is I know there are uncertainties when you put together a flow model, okay.

And given those uncertainties, what do you estimate those uncertainties and, given that estimate of uncertainties, how would that affect your calculated numbers?

Item 3.2, the 2 foot per second velocity criteria stated in there is invalid because of the test data. Now, let me just comment here, and I would like to very specifically comment.

In both reports there are -- the references that are made are made to in some cases NUREG-0869 and NUREG-0897. Now, for my own clarification, I will -- this I would like to have a yes or no answer.

Are these the documents that were put out for comment last May?

MR. PURDY: Yes.

MR. CHIRUVOLA: Yes, those are the documents we looked at and then we put out for comment.

MR. SERKIZ: Okay, the four comment documents. Okay. I had assumed this because given the information in here, then I could see how the next step was taken, okay.

All right, let me make one additional point here, and I want to make this very deliberately. It has to do with this mechanistic versus nonmechanistic, and what I'm referring to is the NUREG-0869 for comment document. On page 2-5, paragraph 2, clearly states "Revised REG Guide 182 to reflect the findings contained in NUREG-0897," which was the for-comment, "in particular the 50% screen blockage guidance should be removed and replaced with requirement for plant specific debris evaluation based on the technical findings described in NUREG-0897."

And the reason I make that point, and that's why I kept coming back to what are you referring to, one of my problems in going through these reports was you've gone to a -- quite a bit of effort to try to make an assessment of your problem.

And then, like for example, in Section 7 everything is put back into the 50% nonmechanistic. And I'm saying to myself, "What do I do now." Okay?

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And that's my question I'm leaving on the table for you, which really leads me to my recommendations that -- you know, I would recommend that you review and revise, as required, you know, based on information principally from the transport of the reflective metallic materials, use whatever of that is applicable otherwise and, since you've essentially acknowledged that you're aware that we said do away with the nonmechanistic, you know, use the guidance that's in the REG Guide 182, Revision 1, which was part of the NUREG-0869.

Now, because the NUREG-0869, which was for comment, I suggest that you use with it, okay, the data in NUREG/CR-3616 so that you have the benefit of this in your evaluation.

Okay, what we have done is revised, or in the process of revising, the 0897 to reflect public comments and including information of this nature. But the information is here.

UNIDENTIFIED SPEAKER: Well, that's good. So you've got whatever is latest -- public in both of these documents.

UNIDENTIFIED SPEAKER: I'd like to make a comment. We will, of course, be very glad to take your recommendation. I just would like to clarify why EBASCO kept it.

Since we had not done any transport, we could not adhere to recommendation of the 0897 performance. So we had to assume it and maybe that's where the confusion is.

MR. SERKIZ: Okay. And I hope, you know, my comments are taken somewhat constructively. I went through it and what I'm saying is look, there is information that's out in the public domain. Make use of it as you see --

UNIDENTIFIED SPEAKER: I was leading to a different conclusion, to follow along on your recommendation and I think we certainly should. It is now imperative that the Gibbs and Hill report be combined into one and forget this independent look because I cannot, you know, as EBASCO do away with that unless I have a study that shows me I can so the two studies combined can be --

UNIDENTIFIED SPEAKER: He recommends that, I'm jumping ahead.

MR. SERKIZ: Yeah, you already stole my punchline, but anyway, let me come back to the EBASCO report.

UNIDENTIFIED SPEAKER: Could always read at the end of a mystery novel.

MR. SERKIZ: Or know the answer and develop the equation. Anyway, going on and rather than spend a lot of time since I guess the suggestion that has been accepted that, you know, you all take a look at this and then decide what to do, my general comments are very similar.

I think that your -- the EBASCO people should utilize the reflective metallic insulation transport tests to develop or evaluate. And, of course, you know, I include here -- and this is my jargon -- the NUREG-0897, Revision 1, which is the revision that has folded into it the findings out of this particular report.

My reason for going on in item 1.2 in my comments on the EBASCO report is that -- and I've already touched on this -- that the REG Guide 182, Revision 1, states -- you draw a conclusion -- "will not result in the loss of available MPSH exceeding 50% of MPSH requirements."

And I very honestly don't know where you pulled that out of. If you can show it to me, I would be happy to discuss it with you, but I don't -- I don't understand this statement, and it may have been a phraseology.

MR. IOTTI: I think it's a phraseology. It wasn't intended to sound that way.

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MR. SERKIZ: Okay. The REG Guide 182, Revision 1, for the record, simply states that you'll do a mechanistic type of evaluation of your debris generation transported and the subsequent.

And it in no way, okay, ties it to giving you a go or no-go exceeding 50% of MPSH requirements. There is a table in the REG Guide 182, Revision 1, that was in NUREG-0869 for comment, that at one time we were trying to come down to something as specific as that.

Follow-up discussions on that, particularly public comments received, etcetera, you ran into a situation that you could not get agreement on a singular number.

That has been deleted as a result of public comments and peer panel input. I'll sort of go down quickly. On -- I'll be frank with you. I didn't understand your static conditions model being applied to a dynamic flow condition, and that's the only way I could state it. And this is in the EBASCO analysis.

MR. IOTTI: That's confusing. We'll have to revise that --.

MR. SERKIZ: Okay, ir it's a confusion -- in fact, I had thought I would be asking questions on that and, given your comments that went with your slides, I really now don't understand how I used the static analysis versus the dynamic analysis that you presented this morning on the board.

MR. IOTTI That's correct. Our report will have to be amended to reflect what I just told you.

MR. SERKIZ: Okay. Anyway, my comments or the conclusions in your executive summary are not substantiated by this report on my views. On page 2 you talk about an experimental screen blockage loss, a coefficient of 28 or 50% block screen.

I did go to the Western Canada report and, in fact, it was at that point I said I would be better off calling someone at Western Canada and trying to get a clarification of how to use that number, plus what would be the corresponding number for this blockage of roughly 90% because nowhere in the Western CAnada report do they ascribe any uncertainties.

Okay, I've not closed that loop, although I did talk with a gentleman yesterday there who's going to call me back today or tomorrow. The man that signed off on this report has left the company so it's taken me a few days to try to close the loop.

My item 2.4 again goes back to the static environment and I'll not comment on that. I would make this point. Having, you know, had the benefit

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of seeing the tests run at Alden that are reported in NUREG/CR-3616 and the Gibbs and Hill report where you try to look at different size equivalent diameter particles and so on, there is an overlapping and I think the methodology that was pulled out of the -- the NUREG/CR-2791 can be tuned or correlated with this and, in fact, you are calculating transport velocities for some of those equivalent diameter particle sizes on the order of four-tenths to 1.2 feet.

Again, you get back to the problem that we all face when we talk about debris of a specific nature. What are the size, shape, physical characteristics? Okay. I don't have an answer for you there.

And really, my recommendations on item 3.2 is I think the physical characteristics of the debris that you do assume for your analysis are going to be a major factor in your conclusions.

And again, my recommendation is the same. Let's do it, you know, through a mechanistic approach such as REG Guide 182, Rev 1, is asking for and a combined report -- and this is where I guess I would speak back to the utility representatives -- that focuses on both type materials and the MPSH impact would be a documentum, I think, that would be more useful to staff to sit down and say okay, the conclusions on

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MPSH, margin of thus and thus, from these type of material considerations and, you know, here's the supporting analysis of how we got there.

So that's my saying. If you have questions for me, I'll be happy to, you know, talk now, later, whatever.

MR. FIKAR: Well, Al, your comments are well taken and we will consider them and incorporate them. Now that we've had input back from you --.

MR. SERKIZ: Sure.

MR. FIKAR: For the utility and our consultants.

MR. IPPOLITO: Let me go around the room. -- do you want to --

MR. MARINOS: Yes, I'd like to -- my name is Marinos. I'd like to reiterate a question I missed earlier and I think it would be advisable to submit a formal response to the question and I will reiterate the question.

Is the effect of the impurities that make it through the filter, through the water and through a course of heat exchanges and into the reactor, the effects on the heat transfer capability of the water through the heat exchangers can indeed react the vessel?

MR. IPPOLITO: Is that understood?

UNIDENTIFIED SPEAKER: Yes.

MR. IPPOLITO: Dick, you want to make some more comments? No?

MR. BURWELL: I have several. First of all, to me, it appears to be an inconsistency on the circuit tension of the smaller particles and once you do a combination of the Gibbs and Hill and EBASCO report, I think you will need to come to some common resolution of what does happen to smaller particles.

Now, secondly, if I may turn to the EBASCO report, Table 1. This concerns the paint details, and what I'm searching for is a clarification. On item 3 you have "unqualified paint" and I would like a definition of unqualified paint, in essence, going back to the last slide that you used concerning proposed coating practices.

What do you mean by "unqualified paint"? Do you mean that -- the 17,000 square feet of unqualified paint, do you mean that that is simply the quantity of paint that does not -- is not under the direct purview of Appendix B but is, in fact, qualified materials and was put in by qualified applicators and you used approved application procedures? Or is there some dividing line elsewhere along here?

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MR. FIKAR: Are you referring to the EBASCO --?

MR. BURWELL: Yes, right.

MR. FIKAR: Bob, can you answer that?

MR. IOTTI: I'll try to answer it. I'm not so sure I'm the right person, but my understanding of the unqualified paint is that paint which cannot be proven or disproven as being qualified under the purview of Appendix B.

For instance, overspraying side tube steels. You know, there is overspray but how do you prove it's being applied properly within it.

MR. BURWELL: Then don't call it unqualified paint.

MR. IOTTI: Well, call it paint that -- whose qualification cannot be proven. I'd be delighted to change -- I would like to take that report and change it, to be honest with you.

So we will take -- we'll have our opportunity and we'll do so.

MR. IPPOLITO: Let me just say you can call it -- as far as the NRC is concerned, you can call it whatever you want to call it, but we would like to have it defined.

MR. IOTTI: Yes, the point is well taken. We will address it.

MR. IPPOLITO: At least you understand what we mean by "unqualified".

MR. BURWELL: Yes. And additionally, if you need to qualify -- make other distinctions in it, why please do so. I'd like to understand -- I'd like to have some picture of what do you believe is the quality of the paint in the containment.

MR. IOTTI: Well, I'll tell you the answer to that, okay? It's good. And it will be qualified and this is by comparison to all of the other containments which I've been part of at EBASCO.

This is not one of our plants. I'm just comparing this paint to what we have at --. And Jerry Firtel, I don't know whether you care to make a comment in that regard. He's our paint expert. But we will make such a statement.

MR. BURWELL: Fine. But if you people attach quantity to this thing, it would be most helpful.

MR. SERKIZ: I would be for a definition of quantity.

MR. IOTTI: We'll do both. We'll quantify where we cannot -- we quantify but we cannot qualify.

UNIDENTIFIED SPEAKER: Well, can't it be qualified exactly what's on the exempt log?

MR. IOTTI: Essentially.

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UNIDENTIFIED SPEAKER: Let's use the term "indeterminate" as opposed to "unqualified" so you don't mix it up with DBA testing. Indeterminate.

UNIDENTIFIED SPEAKER: That is a better word.

MR. SERKIZ: Let's see, going around, Phil, any comments? Jack?

MR. KUDRICK: I have just a couple comments and one is for both of the studies the question of chemical stability of the coating, is there any question based on criteria that the coatings will be chemically stable?

MR. PURDY: They are DBA qualified paints throughout.

MR. KUDRICK: So that from the standpoint of Gibbs and Hill --

MR. PURDY: Yeah.

MR. KUDRICK: -- the understanding that you have 100% qualified paint from the standpoint of chemical stability. The worst that could happen would be that --.

MR. PURDY: Yeah. The paints have been -- as near as possible the paint has been -- application. We have good quality -- and we know that they are stable materials.

MR. KURDICK: The other question I have is a question of understanding and I'm not sure I understand how you committed the approach velocity in the sump vicinity by assuming that you had an approach velocity of .08 feet per second and you had one sump cperating and you doubled that approach velocity if you have two. Did I misunderstand you?

MR. IOTTI: Jack, maybe there's a slight misunderstanding. The approach velocity is still the same on each sump. What happens is, of course, now you have two sumps working.

As you go away from both sumps, you get to restricted area and the same -- of containment you have twice the flow into each of --

MR. KURDICK: Assuming one flow area -- one flow restriction.

MR. IOTTI: Right, one flow restriction. So that's why you get the -- double.

MR. KURDICK: Okay. That's all the questions I have.

MR. IPPOLITO: Any other staff I missed?

MR. BANGART: How much painting is left to be done? Where do you stand right now?

MR. FIKAR: Inside containment 1.

MR. GEORGE: In containment 1 there is still some remaining on elevation 808 in 832. The surface

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preparation in both of those areas is nearing completion and the application of coating will end shortly and we're -- all of that containment in a -- a late August time frame.

MR. BANGART: So you're going to proceed applying as if it were done under --

MR. GEORGE: Yes.

MR. FIKAR: We're going to go on today, just as we were yesterday, until we get something different.

MR. CLEMENTS: Under Appendix B until we get further notice.

MR. BANGART: You may be essentially done before you get --

MR. FIKAR: Well, let me pray. I hope not. We'll talk about that at the end.

MR. IPPOLITO: Any other staff questions? Any questions from anyone else? Go ahead, Chang.

MR. LI: About the color and size that you studied here, when you justify the size do you discuss what -- this size smaller than one-eighth of an inch, how it is when it's passing through the screen, goes into -- pumps --?

MR. IOTTI: Well, we haven't addressed that and this question is very similar in nature to the question that Dr. Marinos asked, what happens now when

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you have particles entering in the water and you pass it through the various heat exchangers and into the core and we will have to address that separately because we haven't addressed it in any detail whatever until now.

So you'll just have to wait on that until we can formulate an answer to this question. I think your question is the same as his. In terms of the immediate blockage, the pump passages are sized to pass any particles that's smaller than an eighth of an inch.

So the immediate effect -- the only effect it could have is really an effect on heat transfer in a heat exchanger if it were to deposit and foul the heat exchanger.

MR. MATHEWS: But as part of the heat transfer question I think you should at least --

MR. IOTTI: Yes, we will address it.

MR. MATHEWS: -- heat transfer from the fuel.

MR. IOTTI: Yes, we will address it. To me that's a heat exchanger, too. It exchanges out instead of in, but it's really the same thing.

MR. IPPOLITO: I believe you had a question. Would you identify yourself, please?

MR. CHEVAK: Yes, I'm Gilbert Chevak and

I'm a representative from the Government Accountability Project. I would just like to say that after I discuss and review my notes with my colleagues, we will submit any questions we have to you in writing.

MR. IPPOLITO: Thank you. I guess the staff has concluded its comments and questions. Let us take about a two-minute break. I wanted to talk to some of our folks and I think we need to respond to a few particular things and then I'd like to go --

(Brief recess.)

MR. FIKAR: We have -- this is Lou Fikar with TUGCO -- we have a couple of clarifying points. We thought we'd rest and then we'll be ready to close. First, in response to Jack's question on the chemical stability of the paint, Mr. Purdy would like to make some clarifying --

MR. PURDY: Apparently, my answer to your question confused some people. All the paints applied within the containment are qualified materials and procedures in accordance with NCN 1012, and are chemically stable materials as applied.

I think we're all aware that there is an exempt clause paint where an inspection was not conclusive. And therefore, we can't say that they're 100% in accordance with NCN 101.2 as applied, as presently on the wall. But that does not -- but they are still chemically stable. Does that clarify?

MR. KURDICK: Is it a question of trackability of the materials?

MR. PURDY: No, the material is trackable.

MR. IOTTI: I think one way to define it is that chemically the material is the same material and therefore it's chemically qualified. What you cannot prove is totally qualified is because you haven't totally demonstrated the application, its physical adhesion.

MR. FIKAR: Jerry Firtel, you can clarify that.

MR. FIRTEL: We maintain an exempt log to keep track of all of the indeterminate coatings that goes inside the containment. Now, there are a number of situations that will come up in Comanche Peak and other nuclear power plants as well.

There may be some inaccessible areas or limited access areas where qualified coating may be applied, or will be applied, but you may not be able to have total inspection relative to dry film fixes and things of that nature.

There are small pumps and motors that come into the plant that are standard, manufacturer standard.

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What we do with these is primarily put on a chemically stable coating on top of that to make it decontaminable.

The coating that's underneath may or may not be stable. We're not sure. Sometimes these coatings come in that basically we're unable to determine what coating is on there.

There are other pieces of equipment that fall into this same category where we will come in -- where ever we can, we will strip the coating down if it's indeterminate and then reapply.

There are occasions where the equipment is very sensitive. Blasting could be a problem with grit and things of that nature, dust getting into the sensitive equipment.

We would then put on a barrier coat, or put on a coat on top of that at least to make it decontaminable. There again, it's a question of whether it is in fact -- the original coating is, in fact, chemically stable.

But we track this on a regular basis and we have a square foot number and we also have a breakdown of every piece of equipment and pipe and all the inaccessible areas on this exempt log, and it's kept up on a daily basis so we have a number that's current.

MR. FIKAR: Thank you, Jerry. And let me

point out too the exempt log -- there's a very small quantity of paint in that compared to all the paint in containment.

And all the rest of the paint in containment, except for these few minor exceptions, is under Appendix B. It's quite probably qualified and we've got a procedure to make sure it gets on there properly and we've got an excellent QAQC program to verify all this.

I wanted to make that point. And we're continuing to do that to this minute. Dick, did you have a question?

MR. BANGART: When you say small, what's small in terms of --

MR. FIKAR: I'd say less --

MR. BANGART: -- and secondly, is there a limit that you've established that beyond such and such a change you're not going to have an exempt log?

MR. FIKAR: If you heard us today, we're going to say all of it. Right now it's a very small quantity that we're calling indeterminate. Less than 5% of the paint -- Jerry, what's it? I've forgotten what the number is. It's not a very large number. Less than 10%.

MR. STEFANO: But you are proposing to take it all out of Appendix B now?

MR. FIKAR: Yes, sir. Now there was another clarifying point we needed to make on this.

MR. GEORGE: Yes, Joe George here.

MR. FIKAR: In response to the question.

MR. GEORGE: In response to Mr. Burwell's question regarding Table 1 in the EBASCO report which does list -- it terms as unqualified a certain amount of coatings. And this could better be described as indeterminate because it is the amount of paint on the exempt log that is required by our commitments to 10 CFR 50 Appendix B program, which is the existing program.

It should not be confused with the program that I described to you on Slide 31, which is the program we intend to follow for any activities once the items are resolved to the NRC's satisfaction.

What we are saying is that based on our studies, these coatings in containment need not be safety related. And the safety significance -- indicates what level of inspection is indeed required and our program will depart from past practice.

That's what we're saying and the exempt log would essentially, if these are approved, would not exist.

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MR. FIKAR: Thanks, Joe. With that, let me summarize what we've done here today. Our objective was to present to you today and to show you that the specific design of Comanche Peak containment and some is such that the coatings have no safety significance.

Therefore, the application of these coatings need not be subject to the requirements of Appendix B. Our presentation demonstrated by two separate and distinctly different methodologies that required sump performance at Comanche Peak will not be impaired by any postulated coating failure up to and including 100%.

ECCS performance is thus not affected by containment coatings. And even listening to your comments and other things, we still feel that way, but obviously we'll address that.

Be assured we want a high quality paint job on the containment paint, as we do elsewhere in the plant. Common sense and sound economics dictate that any highly labor-intensive effort be done effectively and efficiently.

Let there be no misunderstanding about that. We all know that work under Appendix B, with its rigorous requirements, is quite costly. When that cost is necessary, we will pay the price.

However, where safe reactor operations do not require the application of Appendix B, there is no safety or regulatory basis for doing so. We have concluded that Appendix B need not be applied to the coatings at Comanche.

We are seeking your priority review of our proposed efiserinimin (phonetic) and we'll support your review efforts and we will incorporate some excellent comments we received today and your recommendations and we will consolidate these reports in a very short time.

And we will also have here within a 24-hour notice, if we can get it, any of the people that you need, Tom, or Mel or any of you, to respond to your questions to complete this review because obviously we're quite anxious to get it resolved as soon as we can.

So again, we'll take into consideration the questions and comments we've got today and, hopefully, then get it back with you all and have any additional reviews we need. And with that, that concludes our presentation.

MR. IPPOLITO: I guess I have to make one statement. I'm not sure I understand it completely, but let me try, and that is the standard review plan in this area provides guidance and this guidance is usually a REG guide, which we all know is not a part of the regu'-tions.

Some of the documents that have been identified to you today are not in the standard review plan. These documents represent, however, the most current staff evaluation of these areas.

The applicant is free to use whatever he needs and cares to use to make his case. I guess that's the end of the statement. Have I confused you?

MR. FIKAR: We all know that.

MR. BURWELL: Fine. If there are no other statements, I would like to thank the applicant for coming in.

MR. FIKAR: Incidentally, we're prepared, if necessary, to stay on today if we can expedite this effort, Tom, so I'll leave it with you and Joe to work that out.

MR. IPPOLITO: Doggone it, Lou.

MR. FIKAR: We're anxious.

MR. IPPOLITO: I cannot --

MR. BURWELL: Thank you.

MR. FIKAR: We're going back to Dallas.

END OF MEETING

AGENDA

NRC MEETING

BETHESDA, MARYLAND

JUNE 7, 1984

I. INTRODUCTION - L. F. FIKAR

II. PURPOSE OF PRESENTATION - J. B. GEORGE

III. SAFETY IMPACT ANALYSES

A. GIBBS & HILL - D. C. PURDY

B. EBASCO - R. C. IOTTI

IV. PROPOSED PRACTICE - J. B. GEORGE

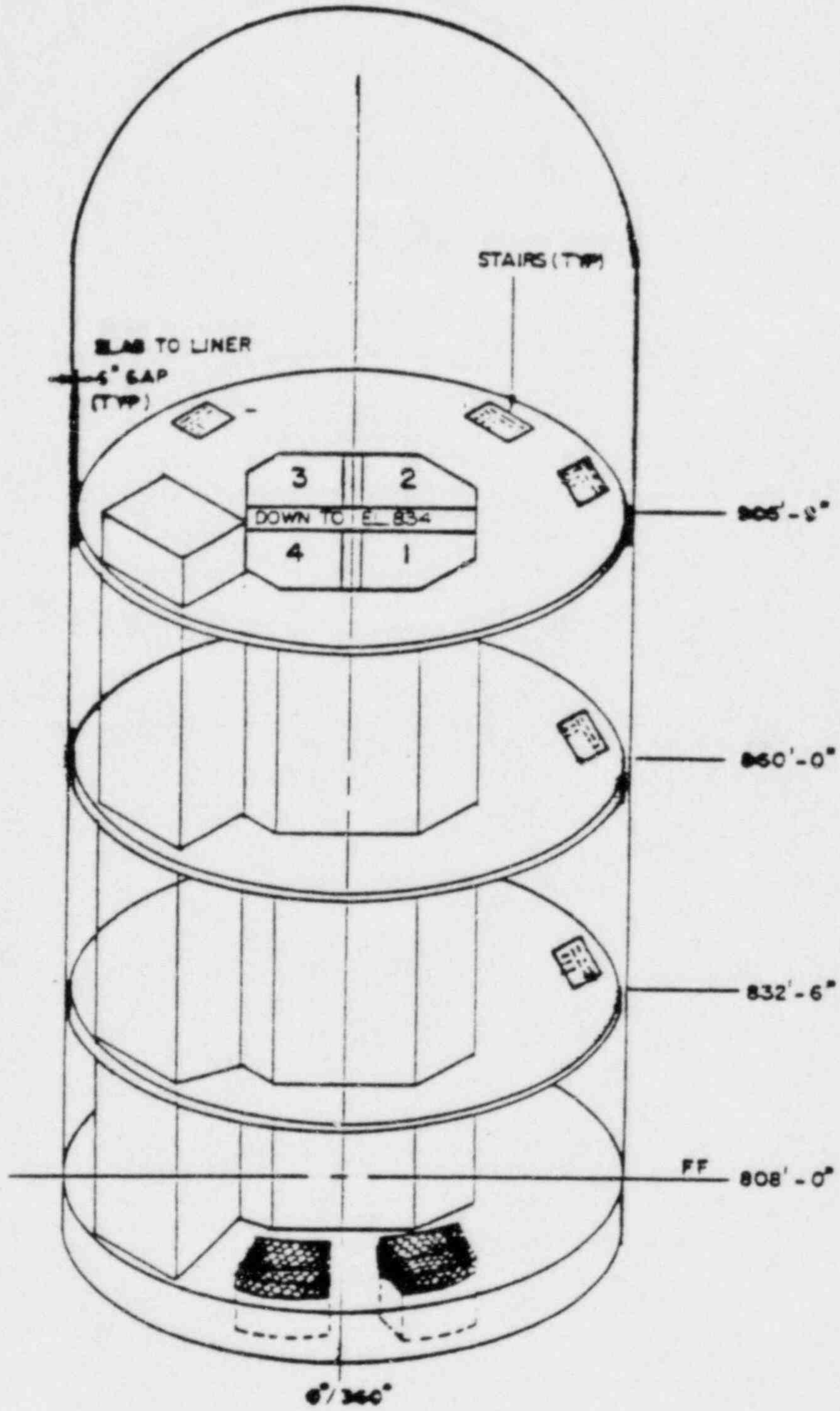
V. SUMMARY AND CLOSING - L. F. FIKAR

PURPOSE OF PRESENTATION

1. PRESENT STUDIES PERFORMED
   TO REVIEW NEED FOR CONTAINMENT COATINGS TO BE SAFETY RELATED AS A FUNCTION OF SUMP PERFORMANCE
   (A) DETAILED REPORT BY GIBBS & HILL
   (B) INDEPENDENT REPORT BY EBASCO

2. CONCLUSION
   COATINGS INSIDE CONTAINMENT NEED NOT BE SAFETY RELATED AS THEY HAVE NO SIGNIFICANCE TO SAFETY

3. CPSES CONTAINMENT
   ITS SPECIFIC CONFIGURATION IS SUCH THAT TRANSPORT OF DEBRIS IS EXTREMELY DIFFICULT AND/OR INHIBITED



CONTAINMENT ELEVATIONS
WITH SUMPS

EVALUATION OF PAINT DEBRIS EFFECTS ON

CONTAINMENT EMERGENCY SUMP PERFORMANCE

BY

GIBBS & HILL, INC.

POTENTIAL SAFETY SIGNIFICANCE OF COATINGS

1. PRIMARY PURPOSE OF COATINGS
   - A. CORROSION CONTROL
   - B. DECONTAMINATION (ALARA)

2. EFFECT OF POTENTIAL COATINGS FAILURE ON ENGINEERED SAFEGUARDS
   - A. ECCS SYSTEM - POTENTIAL FLOW RESTRICTIONS
     - SPRAY NOZZLES
     - PUMPS
     - SUMP SCREENS
   - B. HYDROGEN GENERATION
   - C. VENTILATION SYSTEM PERFORMANCE

COATING MATERIALS

STEEL SURFACES

A. INORGANIC ZINC PRIMER

B. EPOXY MODIFIED PHENOLIC FINISH

C. REPAIR AREAS

CONCRETE SURFACES

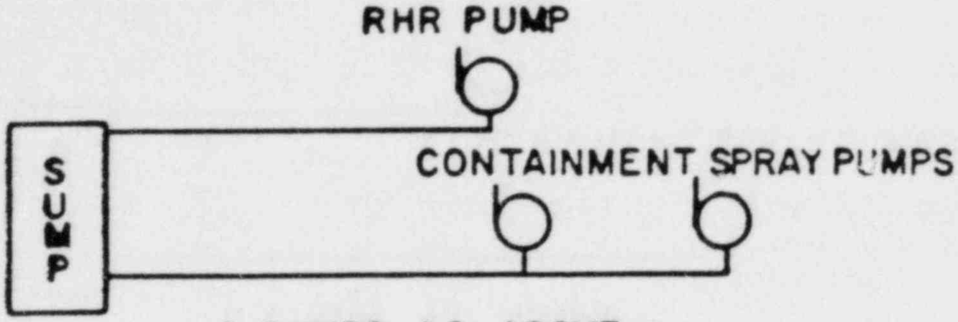
A. EPOXY SURFACER

B. EPOXY FINISH

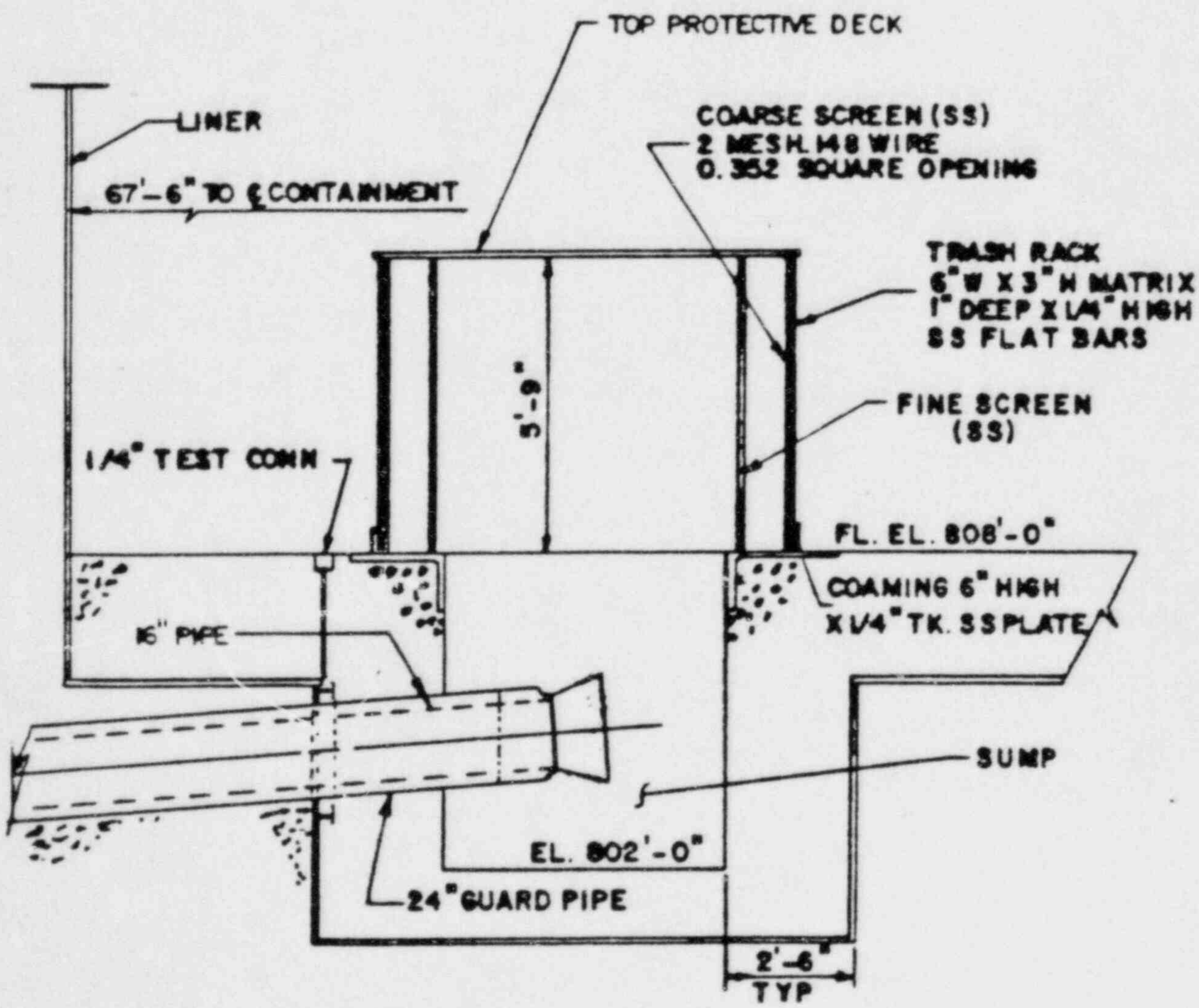
MATERIAL STORAGE REQUIREMENTS

SUMP PERFORMANCE - I

SCHEMATIC



2 SUMPS AS ABOVE



CONTAINMENT EMERGENCY SUMP 7

SUMP PERFORMANCE - II

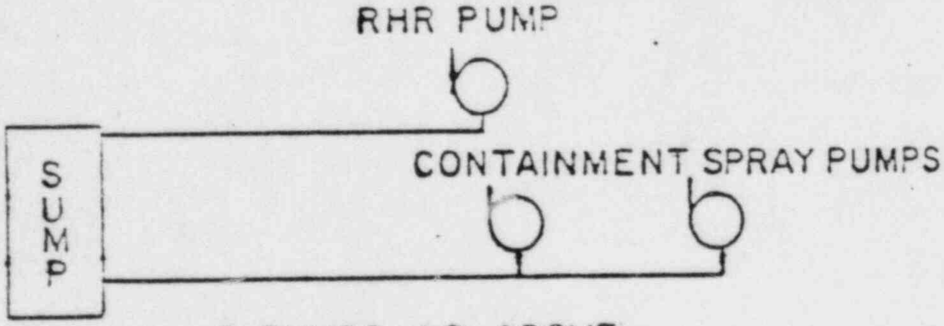
DESIGN CRITERIA

1. ONE SUMP (ONE TRAIN) SUFFICES

2. ARBITRARY 50% BLOCKAGE (NRC REQUIREMENT)

3. SAFEGUARDS ACTUATION SIGNAL ACTIVATES
   ALL PUMPS - MAXIMUM FLOW CONDITION

SCHEMATIC



2 SUMPS AS ABOVE

SUMP PERFORMANCE REQUIREMENTS - III

WESTERN CANADA HYDRAULIC LABORATORIES, LTD. TEST RESULTS

ITEM	FLOW - GPM	ΔH - FEET
TRASH RACK & SCREENS	12,500	0.011 (50% BLOCKAGE)
INTAKE 1 - RHR	5,300	0.175
INTAKE 2 - SPRAY	7,200	0.126

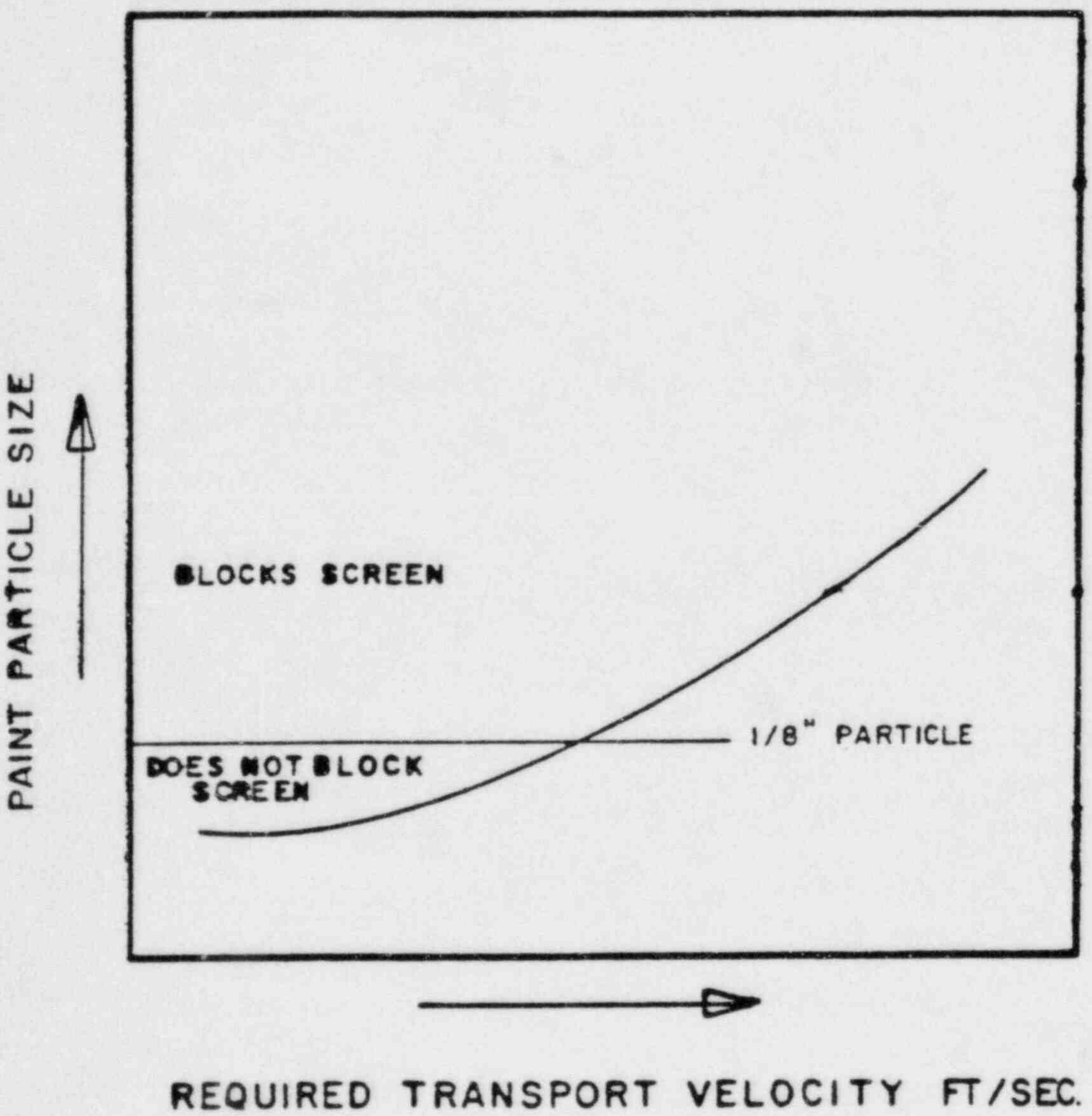
RESULTING NPSH MARGIN - DBA CONDITION

RHR	8.5 FEET
SPRAY	8 FEET

WORST CASE PARTICLE SIZE

FOR PAINT DEBRIS

1/8 INCH



STUDY ASSUMPTIONS - 2

2. PAINT SPECIFIC GRAVITY 1.5 (RANGE 1.5 TO 4)
3. ZERO HIDEOUT OF PAINT DURING TRANSPORT
4. MAXIMUM WATER FLOWS AT DBA DEPTH
5. ZERO PERMEABILITY OF PAINT DEBRIS

STUDY OUTLINE

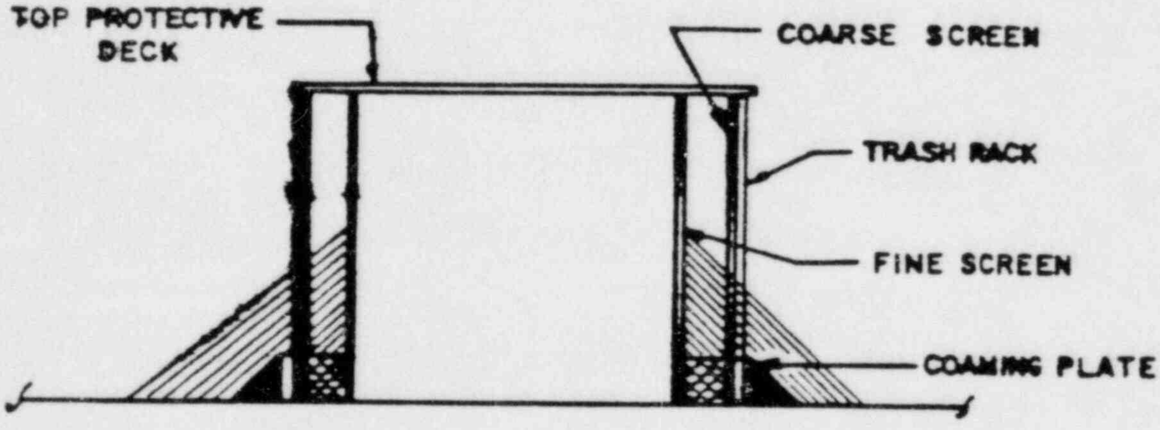
1. Debris generation
2. Debris transport
3. Effects of debris on sump performance

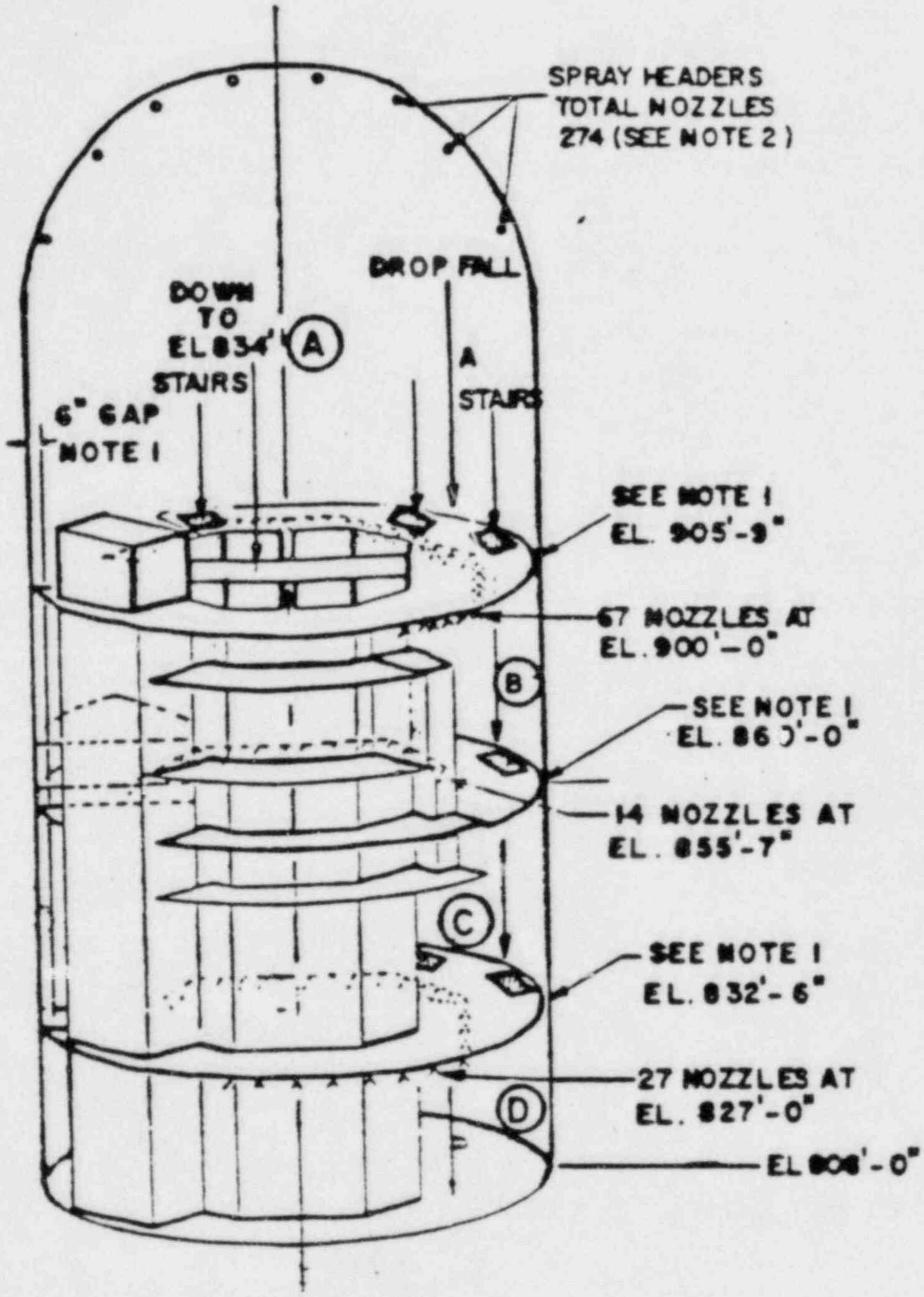
STUDY METHODOLOGY

1. DETERMINE CRITICAL PARTICLE SIZE
2. ACCUMULATION ON SCREEN - CALCULATION OF MAXIMUM ACCEPTABLE QUANTITY OF PAINT (FOR 50% SCREEN BLOCKAGE) = 117,000 SQ. FT.
3. HYDRAULIC PARAMETERS FOR TRANSPORT
   - DETERMINE VELOCITY REQUIRED TO MOVE THE PARTICLE (CRITICAL VELOCITY)
   - DETERMINE ZONES WHERE CRITICAL VELOCITY MAY BE EXCEEDED
4. TRANSPORT OF PAINT PARTICLES TO SUMP FROM CRITICAL VELOCITY ZONES
5. DETERMINE TOTAL PAINT IN CRITICAL AREAS (THIS HAPPENED TO BE LESS THAN MAXIMUM ACCEPTABLE QUANTITY)
6. CONCLUSION: IF 100% OF PAINT IN CONTAINMENT FAILED, THE MAXIMUM ACCEPTABLE ACCUMULATION WILL STILL NOT BE EXCEEDED (SUMP BLOCKAGE LESS THAN 50%)

MAXIMUM ACCEPTABLE COATING ACCUMULATION AT SUMP SCREENS

BASED ON 50% SUMP BLOCKAGE: 117,000 SQ. FT.

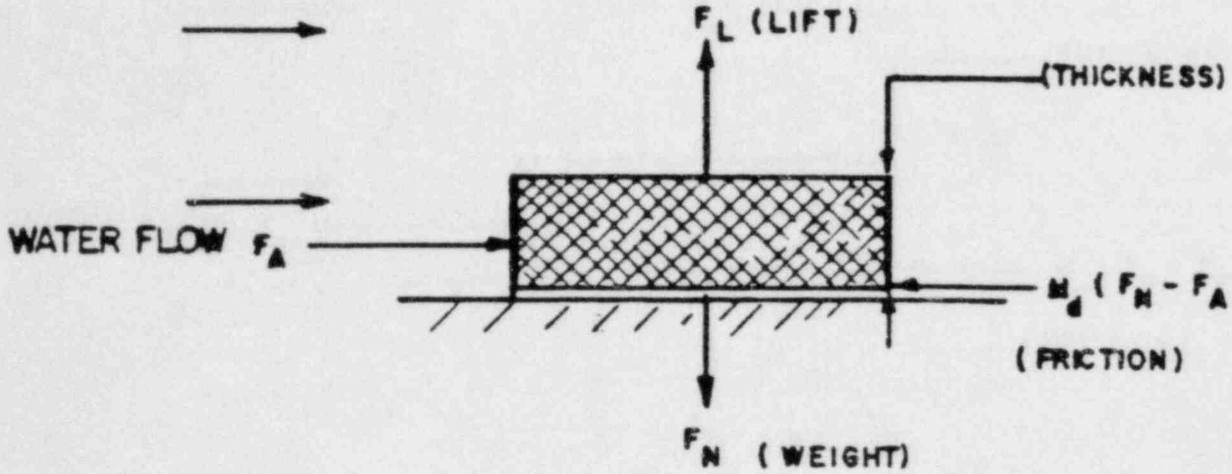




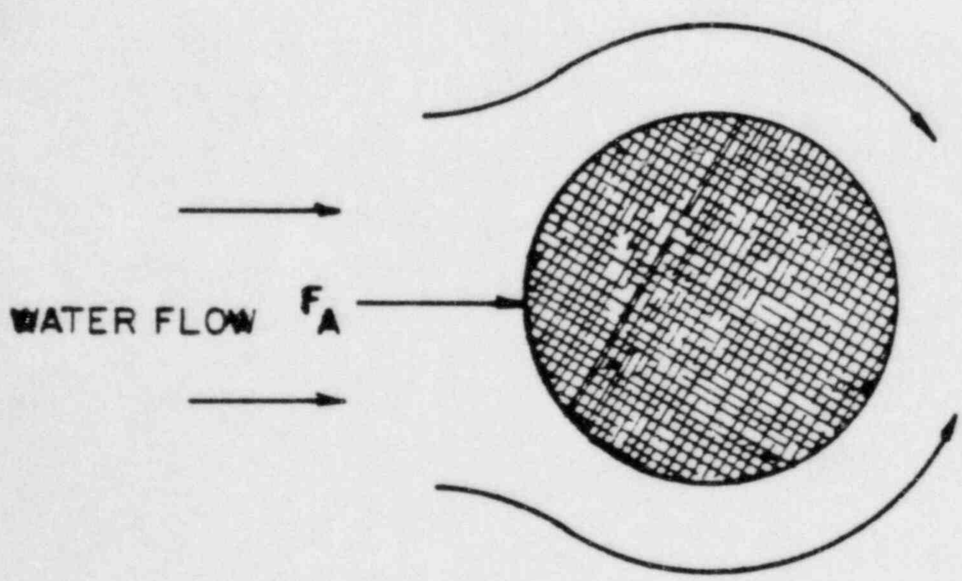
Notes: 1. 6" Gap between Floor & Containment Wall

2. Number of Nozzles shown for each Floor is for One Train only.

CONTAINMENT SPRAY ZONES

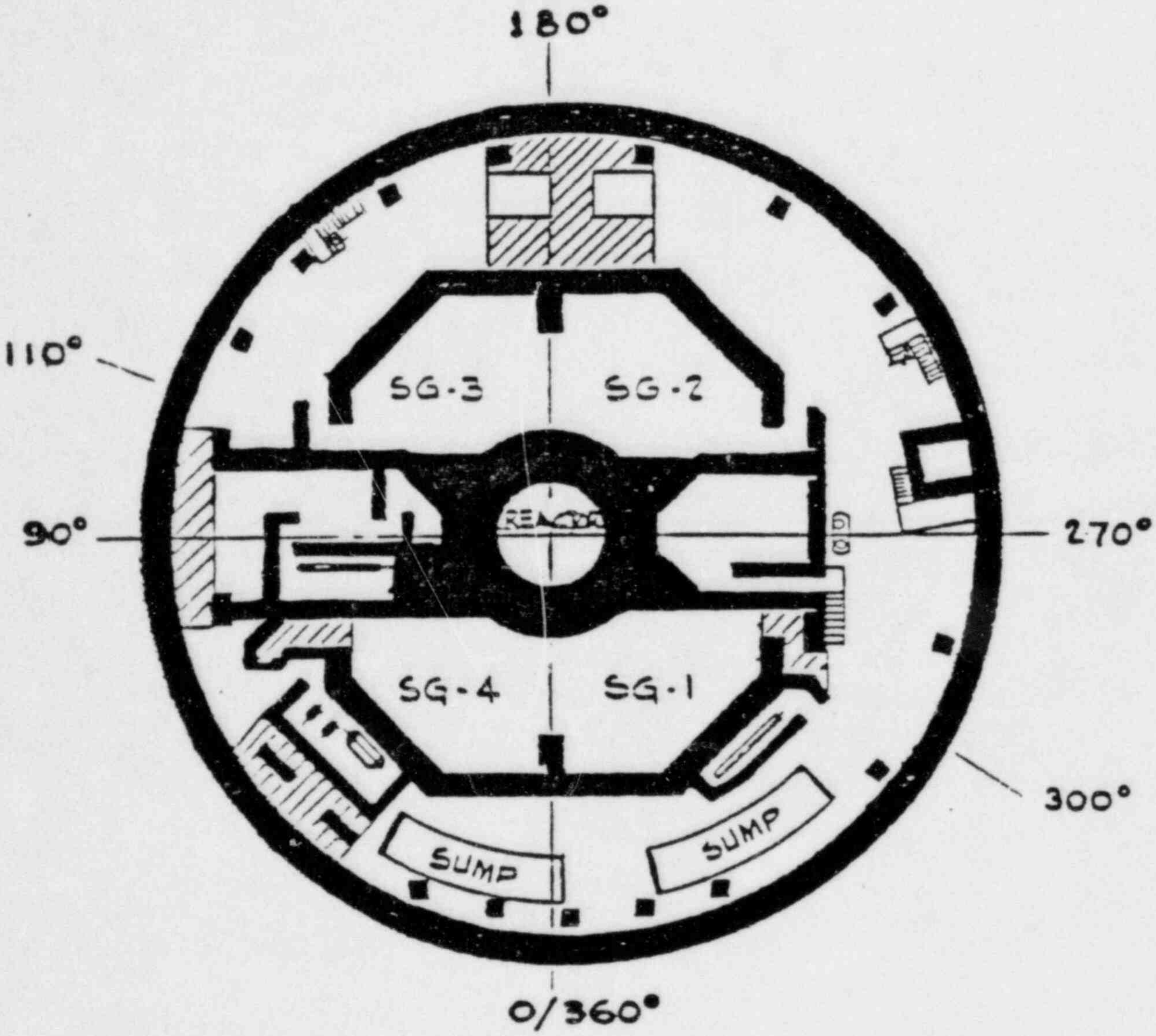


SIDE VIEW



PLAN VIEW

SLIDE TRANSPORT MODEL



AREAS EXCEEDING THRESHOLD VELOCITY

EBASCO SCOPE

- Independent, Bounding Study
- No Knowledge of G&H Approach Until After Completion of Both Studies
- Approach Taken Turned Out To Be Significantly Different Than G&H In Concept/Methodology/Assumptions
- Ebasco Confirms G&H Conclusion that the Effect of Potential Failure On Emergency Sump Performance is Inconsequential With Regard to the Safety of the Plant

INITIAL ASSUMPTIONS
FOR
BOUNDING STUDY

- ALL Paint in Containment is Assumed to Fail as Flecks Greater Than 1/8 Inch in Reality This is Not So.

- ALL Paint is Assumed to Somehow Find Its Way to Vicinity of Sumps.

(This is Unrealistic As Seen From G&H Study)

SECONDARY ASSUMPTIONS THAT NEED TO BE
MADE TO ADDRESS POTENTIAL EFFECTS

- CHOOSE GEOMETRY - THIS NEEDS LATER CONFIRMATION

- CHOOSE MANNER OF ACCUMULATION

  - CHOOSE HORIZONTAL PILING BECAUSE OF LOW VELOCITIES NEAR SUMP
    (NOTE TWO SUMP OPERATION WAS ASSUMED BUT ACCUMULATION IS AGAINST ONE SUMP ONLY)
    - THIS MUST ALSO BE CONFIRMED LATER

- CHOOSE PACKING FRACTION FOR ACCUMULATION

- INCLUDE OR NOT INCLUDE ASSUMPTIONS OF R.G. 1.82 REV. 0 - 50% BLOCKAGE (NON-MECHANISITIC)

FIRST RESULTS

- ALL CONTAINMENT PAINT INCLUDED IN 1000 FT^2 (SUBJECT TO LATER CONFIRMATION)
- 50% OF SCREEN IS ASSUMED BLOCKED
- ALL CONTAINMENT PAINT ACCUMULATES HORIZONTALLY ON TOP OF 50% NON-MECHANISITIC BLOCKAGE (ASSUMED TO BE UNDEFINED DEBRIS)
- PACKING FRACTION = 1.0
- BLOCKED AREA OF SCREEN IS 66.8% AND THIS IS ACCEPTABLE

PACKING FRACTION ASSUMPTION

- P.F = 1.0 IS NOT CONSERVATIVE

- EVALUATED MOST LIKELY PACKING FRACTION TO BE BETWEEN 0.39 AND 0.76

- WE ASSUMED 0.75 SINCE WE ALSO ASSUMED THAT NO FLOW CAN PASS THROUGH THE 0.75 PACKED BED. (THIS IS CONSERVATIVE)

- WITH PF = 0.75, BLOCKED AREA OF SCREEN (INCLUDING 50% MECHANISTIC BLOCKAGE) IS 72.3% ACCEPTABLE

JUSTIFICATION OF ASSUMPTIONS

1 • ASSUMED 50% CLOGGED WITH DEBRIS OBVIOUSLY OK, BUT UNNECESSARY

• VELOCITIES TOWARD SCREEN, IN VICINITY OF SCREENS ARE LOW - AT OR BELOW RECOMMENDED THRESHOLD VELOCITIES OF RG 1.82 REV 1

• ASSUMED ANYHOW

2 ASSUMED HORIZONTAL ACCUMULATION

• PERFORMED SUPPLEMENTARY STUDY.

• BECAUSE OF LOW DRIFT VELOCITY TOWARD SCREEN ANY PAINT FLECK FALLING THROUGH WATER CAN RANDOMLY GO IN ANY DIRECTION THUS RESULT IN PRIMARILY HORIZONTAL ACCUMULATION

JUSTIFICATIONS OF ASSUMPTIONS CONT'D

3. ASSUMPATION OF 1000 FT^2

SUPPLEMENTARY STUDY SHOWS THAT FOR WATER LEVEL OF 9.5 FT, ANY PAINT FLECK AT WATER SURFACE WITHIN 24 FT DISTANCE MAY TRANSPORT AND REACH SCREEN ON THE AVERAGE.

THIS DIMENSION YIELDS AN AREA OF 922 FT^2 WITHIN WHICH ANY CONTAINED PAINT WOULD AFFECT SCREEN. THIS AREA IS REASONABLY CLOSE TO 1000 FT^2. THIS VINDICATES REASONABLENESS OF EMPLOYING SUCH A PLAN AREA FOR ACCUMULATION PURPOSES.

WHATELSE MIGHT BE CONSIDERED ?

- ANY FLECK DESCENDING VERTICALLY NEAR SCREEN THAT MAY BE TRANSPORTED TO SCREEN AND STICK TO IT VERTICALLY.

- THIS COULD HAPPEN IF FLECK IS WITHIN 4 1/2" OF SCREEN. (ACTUALLY NEARLY IMPOSSIBLE SINCE TOP PLATE EXTENDS OUTWARD ABOUT 6 INCHES OR LONG FACE AND 3 INCHES ON SHORT FACE.

- ASSUMED ALL PAINT WHICH CAN FALL VERITICALLY TO SCREEN. THIS BLOCKAGE IS ADDITIONAL TO HORIZONTAL ACCUMULATION OF ALL CONTAINMENT PAINT OVER 922 FT^2 AND 50% BLOCKAGE.

SUPPLEMENTAL ANALYSIS

- PAINT FAILURE WITHIN 4.2" OF SCREEN SURFACE
- PAINT FAILURE WITHIN 24' OF SCREEN SURFACE
- PAINT FAILURE OUTSIDE 24' OF SCREEN SURFACE
- RESULTS

-- 50% BLOCKAGE	- 3.125 FT
-- 1050 FT ^{3} OF PAINT (WITHIN 922 FT^2)	- 1.14 FT
-- WITHIN 4.2" OF SCREEN SURFACE	1.09 FT
TOTAL	5.35 OR 87%

SUMMARY OF CONSERVATISMS

- ASSUMED ALL PAINT SOMEHOW GETS NEAR SUMPS

- NI FLOW THROUGH ACCUMULATION

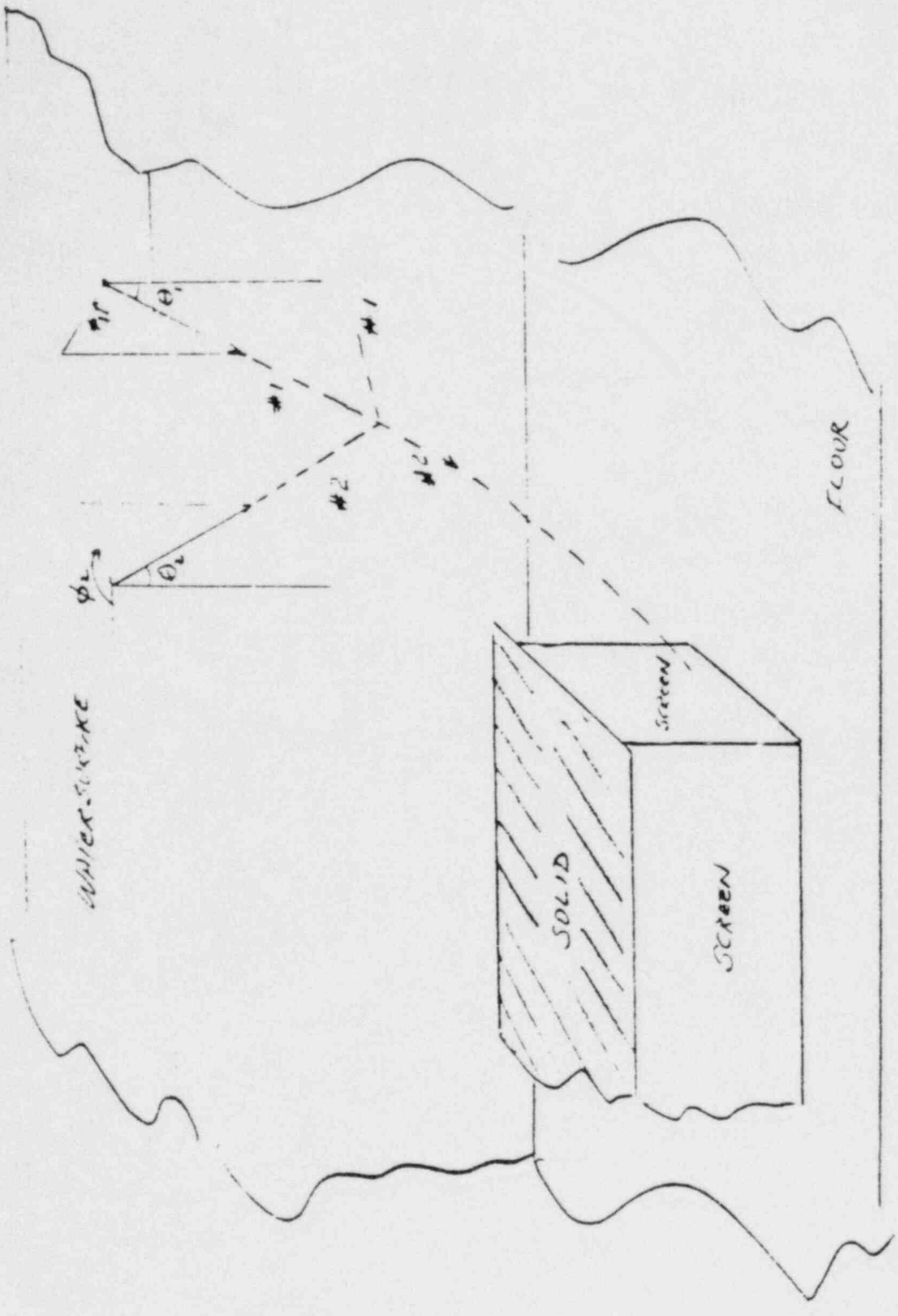
- 50% SUNP SCREEN IS BLOCKED

- WHATEVER STICKS VERTICALLT STAYS THERE
(AN UNKNOWN FRACTION WILL COME OFF)

- SINGLE LAYER PACKING ONLY VERTICAL STICKING
(IE NO FLECK STICKS BEHIND ANOTHER FLECK)

ANY OTHER EFFECTS ?

- FLECK "FLUTTER" THROUGH WATER


SOLID
SCREEN
SCREEN
FLOOR
#1
#2

ANALYSIS OF PAINT FLAKE

"FLUTTER"

ASSUMPTIONS

- PAINT FLAKE STARTS AT WATER SURFACE WITH ZERO VELOCITY- IE SURFACE TENSION ARRESTS IT.
- PAINT FLAKE START TRAVEL THROUGH WATER WITH ARBITRARY VERTICAL AND AZIMUTHAL ANGLE.
- AVERAGE PAINT FLAKE IS FOLLOWED, IE. IF THAT FLAKE CHANGES DIRECTION OR ANGLE OF ORIENTATION IT IS ASSUMED TO BE REPLACED BY ANOTHER FLAKE THAT HAD ORIGINALLY STARTED OUT DIFFERENTLY (IE FLAKES HAVE EQUAL PROBABILITY TO GO IN ANY DIRECTION, ANYTIME -THIS IS TRUE SINCE OVERALL DRIFT VELOCITY IS LOW (0.16 FPS))
- DENSITY OF FLAKE IS ASSUMED TO BE 80 LBM/FT^3 (DIFFERENT DENSITIES DO NOT AFFECT AVERAGE DISTANCE TRAVELLED SIGNIFICANTLY).
- ONCE FLAKE GETS TO SCREEN IT BLOCKS IT VERTICALLY (NO CREDIT FOR OVERLAPPING OR FALLING AWAY FROM SCREEN)
- WATER LEVEL 9.5 FT.

ANALYSIS OF PAINT FLAKE

"FLUTTER"

RESULTS

- FOR NO DEBRIS ON FLOOR, THE FOLLOWING SCREEN AREA BLOCKAGE IS CALCULATED:

  - 88% NOT CONSIDERING ALL CONTAINMENT PAINT WITHIN SECTION NEXT TO SUMP ($\sim 45^{\circ}$ SLICE OF LINER) TO GO TO SCREEN

  - 88% WITH CONTAINMENT SEGMENT PAINT INCLUDED (CONTAINMENT PAINT IS ASSUMED TO COMPLETELY BLOCK CONTAINMENT SIDE OF SUMP)

- FOR DEBRIS ON FLOOR, (50% BLOCKAHE) THE FOLLOWING AREA BLOCKAGE WOULD BE CALCULATED

  - 93% FOR BOTH CASES ABOVE

- 93% BLOCKAGE WOULD EQUATE TO LESS THEN 2 FT OF H_2O P. DIFFERENCE BETWEEN AVAILABLE AND REQUIRED NPSH 8 FT.

PROPOSED COATING PRACTICES
REACTOR BUILDINGS

- APPLICATION PRACTICES REMAIN UNCHANGED
  - QUALIFIED MATERIALS
  - QUALIFIED APPLICATORS
  - APPROVED APPLICATION PROCEDURES

- DETERMINATION OF COATINGS ACCEPTABILITY TO BE ACCOMPLISHED, BUT NOT UNDER THE PURVIEW OF 10CFR50, APPENDIX B OR REG. GUIDE 1.54
  - IN PROCESS VERIFICATION BY CRAFT GROUP OTHER THAN APPLICATORS
  - DOCUMENTATION MAINTAINED FOR SURFACE PREPARATION, PRIMER AND FINISH COAT APPLICATION TO SATISFY THE COATINGS SPECIFICATION

- CRAFT ACTIVITIES MONITORED BY ENGINEERING TO ENSURE THE OBJECTIVE OF AN ACCEPTABLE FINISHED PRODUCT WITH THE DESIRED CORROSION PROTECTION AND DECONTAMINATION PROPERTIES

INITIAL EVALUATION OF COMANCHE PEAK

PAINT AND INSULATION DEBRIS ON SUMP PERFORMANCE

(GIBBS & HILL REPORT)

1) General Comments:

1.1 Evaluation based on documents and information that has been superceeded and updated.

1.2 Conclusions reached are, therefore, contradictory to current findings.

2) Documents which are current:

2.1 NUREG/CR-2982, Rev. 1 (July 1983) - "Buoyancy, Transport, and Heat Loss of Fibrous Reactor Insulation". Contains additional data and uncertainty analyses for heat loss characteristics.

2.2 NUREG/CR-3616 (Jan. 1984) - "Transport and Screen Blockage Characteristics of Reflective Metallic Insulation Materials". Contains results of transport characteristics of metallic foils and assemblies. These tests were run in response to public comments received; results reveal that free internal foils can transport at 0.2 to 0.3 ft/sec (versus conclusion drawn in NUREG-0897, For Comment). These findings resulted in a need to revise NUREG-0897 and R. G. 182, Rev. 1; these revisions have been made.

2.3 NUREG/CR-2791 (September 1982) - "Methodology for Evaluation of Insulation Debris". Some of the assumptions made in this report have been disproved by later experiments (e.g., transport of reflective metallic insulation debris, the assumption that cladding (or encapsulation) can withstand LOCA forces in vicinity of the break). The general approach is still correct, some of the models are now invalid. Use NUREG-0897, Rev. 1 and R. G. 1.82, Rev. 1 instead.

2.4 NUREG/CR-3394 (July 1983) - "Probabilistic Assessment of Recirculation Sump Blockage Due to Loss-of-Coolant Accidents". This report highlights importance of plant sump design and recirculation requirements. An important finding was that: a) the primary source of blockage debris (for PWR's) was insulation on the primary coolant system piping and components and lower portions of the steam generators, b) only pipe diameters of 10 inches (or larger) need be evaluated (for the range of parameters evaluated). These results are reflected in the revisions to NUREG-0897 and R.G. 1.82, Rev. 1.

Result - analyses should reflect findings set forth in these reports.

3) Technical Questions/Comments on Report (as-is):

3.1 What are the calculational uncertainties for the water velocities shown in Table 6-22? It is not uncommon to have potential uncertainties in flow resistances (such as shown in Figure 6-7) of 50-100% depending on how the flowways (see Figures 6-3 and 6-4) were modeled due to the complex plant layout geometries.

3.2 The 2.0 ft/sec velocity criteria cited on Pg. 3-2 (last paragraph) is invalid given the results reported in NUREG/CR-3616. The same comment applies to the conclusion drawn in Step 5 on Pg. 4-2.

3.3 Encapsulation does : afford a significant protection to fibrous materials used as the core insulation - as demonstrated by HDR tests (see Section 3.3.3 and Appendix E of NUREG-0897, Rev. 1). Also SSE forces do not approach LOCA jet forces. Therefore, the apparent conclusions (which might be drawn from Pg. 3-1) are real supportables.

3.4 Section 7.0 is confusing. After all of the proceeding analysis reported, the screen blockage results are reported at 0-50% (see Table 7-2) and R. G. 1.82, Rev. 0 (the 50% blockage criteria) is cited on Page 7-1. Since the applicant has certaintly demonstrated awareness of NRC's planned revision to R. G. 1.82 (which was issued for public comment in NUREG-0869, For Comment), the applicability of Section 7 to Comanche Peak is not understood.

4) Recommendations:

4.1 Review and revise analysis (as required) based on current documentation.

4.2 Assess screen blockage without involving the 5^% blockage criteria and evaluate impact on NPSH margin. Use the guid.nce provided in R. G. 1.82, Rev. 1.

INITIAL EVALUATION OF COMANCHE PEAK

ECCS SUMP CLOGGING

(EBASCO REPORT)

1) General Comments

1.1 Evaluation should be based on current information and findings (i.e., NUREG/CR-3616 and NUREG-0897, Rev. 1).

1.2 Statement is made on Pg. 4 that - "the requirements of Regulatory Guide 1.82, Revision 1 [6,8] states that calculations show that accumulation of debris will not result in a loss of the available NPSH exceeding 50% of the NPSH requirements". Please show exactly where (in the noted references) that conclusion is reached.

1.3 The Ebasco analysis of paint blockage is based on a static conditions model (see Appendix B); how does this apply to the recirculation mode when water motion exists?

2) Technical Questions/Comments on Report "As-Is":

2.1 Conclusions stated in first paragraphs of the Executive Summary are not substantiated by this report.

2.2 On Page 2 the author cites an experimental screen blockage loss coefficient of 28.0 for a 50% blocked screen. What blocked screen loss coefficients were used to calculate the head losses shown in Table II (Pg. 6) and how were these derived?

2.3 Pg. 4 is confusing, conservative assertions are made which are not supported by the references cited.

2.4 Section 3.2 (Pgs. 11-19) is based on a "static" environment. These calcs should be reviewed utilizing the transport characteristics reported in NUREG/CR-3616 (adjusting for density differences between stainless steel and paint materials). The significance of size and rigidity of debris sample is clearly reflected in Table 4-1 of NUREG/CR-3616.

As a point of interest, the calculated transport velocities presented in Section 6 of the Gibbs & Hill report show transport occurring in the range of 0.4 to 1.2 ft/sec for equivalent diameters of less than 3 inches. The ARL tests (NUREG/CR-3616) also show this range of transport velocities.

3) Recommendations

3.1 Review and revise (as required) the analyses prepared utilizing current information.

3.2 Transport and blockage characteristics of paint debris is a function of the assumed size and shape, and local velocities. The application of statie models to a dynamic flow field should be reviewed. The entire question of paint debris blockage warrants careful review and analyses, particular to the physical characteristics of this paint debris.

3.3 Combine the results of this report with the findings of the Gibbs & Hill report and then determine the NPSH impact per guidelines set forth in R. G. 1.82, Rev. 1.

CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the NRC COMMISSION

In the matter of: Discussion of Protective Coatings Inside Containment at Comanche Peak, Unit 1

Date of Proceeding: Thursday, June 7, 1984

Place of Proceeding: Bethesda, Maryland

were held as herein appears, and that this is the original transcript for the file of the Commission.

Joe Newman
Official Reporter - Typed

Joe Newman /AYB
Official Reporter - Signature