# Transcript of Proceedings

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONFERENCE ON ENCAPSULATION OF
ASBESTOS-CONTAINING BUILDING
MATERIALS

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Monday, June 8, 1981

Sheraton National,
Washington Blvd. and Columbia Pike,
Arlington, Virginia

8:30 a.m o'clock

# C O N T E N T S

P R O C E E D I N G S

MR. DORSEY: Good morning. It is just past 8:30. A few more people are coming in, but I think most of us are here.

With us today is Ed Klein, the Director of Chemical Control, Office of Toxic Substances, and he would like to welcome you.

MR. KLEIN: Rather than listen to the noise of the mike, can you hear me in the back?

First, I would like to welcome everybody coming at this bright and early hour all the way out to Virginia. We are here to take a positive attitude of cooperative solutions to programs of asbestos-containing materials in buildings. I guess the one thing that everybody has in common here is that we are all looking for information.

We at EPA are here to learn as well as share experiences that we have had, and we have allowed a considerable amount of time for open discussion and we are really very interested in everybody's views.

I would like to give you a brief summary of EPA's activity. We have been working with encapsulation for two years and we are now entering the second major phase of our work. During this second phase, we will turn the testing encapsulation back to the private sector and we are developing test procedures both from the laboratory and the field and we are working with ASTM to develop performance standards for encapsulation.

Other speakers today will discuss EPA's current and past programs in more detail. Let me give you a quck overview of today's proceedings.

Larry, who manages EPA's school asbestos program will begin by talking about the program and EPA's activities with respect to encapsulation. I hope his remarks will provide a broad context for later discussions.

Next we will hear from three experts who have conducted independent research projects on encapsulants. William Mirick, the principal investigator for Battelle Lab; Ernest Lory of the United States Navy who has evaluated encapsulants in ways Battelle did not; and then there is James Hubbard of the Georgia Institute of Technology who has conducted evaluations of encapsulants in the field.

Forest Reinhardt will conclude the day by speaking briefly about future plans with regard to encapsulants, focusing on a plan to turn encapsulant work back to the private sector and the work of ASTM, which is writing performance standards for encapsulants.

The second day we are going to have a panel of experts who will discuss their experiences with regard to encapsulation in the field. Questions like what are proper application techniques, what airborne fiber concentrations can be expected during encapsulation and other important issues will be raised.

In the afternoon, another panel will discuss decisions to encapsulate. How can you tell if a material is substitutable for encapsulation, what does it do to the insulating properties of the encapsulating materials. We hope that we will have a lot of time for questions and discussion.

With that I will turn it back to Larry. Thank you very much.

MR. DORSEY: Thank you. In today's presentation I know the way that we are set up it appears rather formal, set up for our presentations. I would like to ask that if you have a question, as it and keep the discussions as informal as possible. The purpose of this meeting is to discuss the research needs and to also present to you some of our findings from some of the research that we have sponsored in the past.

Many of you are the experts out there. You have been in the business. You have worked with the various sealants. We would like to share that information. We would like to share what we have done in the past, what we hope to accomplish in the future and get your suggestions and ideas.

So please, I solicit any questions and comments at any time. So that we all have a common basis, some of you have been involved in our program in the past. Some more than others.

I would like to go over a short history as to how we got into the school asbestos business, which will give us a point of reference when we are discussing the need for future research in the sealants.

In 1978, the Environmental Defense Fund petitioned EPA under the Toxic Substances Control Act to regulate the school asbestos problem. At that point we didn't have information and background, we didn't know if there was a problem, but we started research and started investigating.

What we discovered immediately was that many school systems were attempting to deal with their asbestos problems without good technical information.

There was not a guidance document to help people. Some people were over-reacting, attempting to deal with an asbestos problem that we say is not a problem. Others were attempting to ignore the problem.

We contacted the experts throughout the country, Mt. Sinai, Sawyer at Yale, various people in the research business, and developed a guidance document and this was the initiation of our school asbestos program.

Copies of the documents have been distributed today. We mailed this guidance document to every school district in the country, set up a program to make them available through an 800 number and it has been the backbone of our program.

Concurrent with announcing this technical assistance program, we initiated the regulatory program. To develop a regulation is quite a lengthy and diffcult process. I know that the posture of the country at this point is anti-regulation, and if you have been involved in a rule making process, I don't think you need very many more people to slow you down.

It takes about 18 months to two years to develop a regulation and that is really an ambitious program. That is saying that all the pieces of information will come together. We didn't know the scope of the problem, the range of the problem, some of the technical difficulties that we would encounter.

One of our concerns was attempting to identify the schools that require corrective action and attempt to give people reasonable guidance and recommendations on how to correct their problems.

We say that you can remove the asbestos, encapsulate it, enclose it or in some cases, you can set up a maintenance program and defer action.

Our work on the encapsulating agents at the point when we wrote the guidance document was almost nil. We knew that various agents were being used. There was research underway to test various sealants. The only contact I had was to visit various sites where sealants had been used and it was a very, very difficult process to provide guidance at that point.

I think we have come a long way in that area, but when the guidance document was written, we knew very little about sealants. Along the way in developing the rule, we were working with an algorithm, an exposure system. Sawyer at Yale, one of the most thorough research papers dealing with this problem, in '77, he identified a problem with the Yale School of Art and Architecture. In his paper we went through with various tests, et cetera, and had measured levels, removal and various simulation studies, et cetera.

In 1978, the Secretary of HEW notified the various health departments throughout the country that there was a potential problem associated with this asbestos material, but no recommendations or actions or how to deal with the problem.

It is not a new problem. In 1973, EPA under the Clean Air Act, banned the future application of the sprayed-on material. At that point, we were not concerned with problems in existing structures or with the material in existing structures, but subsequent to that, more and more problems were identified.

This material came into its own in the late fifties. It is a technique that was developed in England and after World War II, it came into wide use in the United States. For some reasons, we also had the baby boom and a number of things coming together and in the late fifties we needed a number of schools built and the cheapest way to build them was a steel structure with a pitched roof and outside the sprayed-on material.

Throughout the United States, we have identified schools with the sprayed-on asbestos material. There are a number of programs underway. We envisioned at one time a broad regulation requiring inspection of every school in the country and that would be connected with an abatement program requiring corrective action.

A number of difficulties in developing that regulation, primarily in developing a standard or an exposure system that anyone could use to determine which schools required action where the material had to be removed.

We have backed off and are ready for final promulgation of a regulation requiring identification of all the asbestos materials in the schools, plus a notification system to all the employees that asbestos is present in that school.

We are concerned with custodians, maintenance workers, builders of schools. If we have to disturb the material, there are precautions and techniques that we recommend. So at this point we are not requiring any corrective action in any school in the United States.

We are requiring identification and that a management system be established in the school where the asbestos material has been identified. This is primarily to notify the workers in that school that asbestos is there and not to disturb it.

We are continuing our research on the various aspects of the program with sealants, also with developing this exposure assessment system and providing technical assistance to school officials and other building owners on how to deal with their problems.

The focus of the conference is sealants. Bill Mirick will give our opening presentation. Bill has been working with us for over two and a half years. He started under this air contract testing various sealants. When we initiated our program, he travelled throughout the United States with us, and we have provided him what information we had then on sealants.

We are very close to getting a final report from Battelle. When that is available within the next month, it will be distributed to everyone.

Forest Reinhardt is actually in charge of distributing the report and has been the contact in our office.

If you would like a copy, leave your address with Forest, and we will send a copy to you.

Are there any questions on what I have discussed?

It is a lot of information in a very short time, but I wanted to explain why we are in the business and why we are sponsoring this conference. Again, the purpose of the conference is to discuss the research findings of the past, various research programs, not only what we have sponsored, but Navy programs, Georgia Tech, et cetera, and also to discuss future research needs.

With that, I would like to introduce Forest Reinhardt, who will be the moderator for the panel discussion tomorrow and also will be moderator today.

Most of you, I think had talked to Forest or been introduced to him in the past. He is a person on our staff that is our expert on sealants and has been the one that developed the sealants guidance document and has distributed it.

With that, I would like to introduce Forest Reinhardt.

MR. REINHARDT: Good morning. We seem to be running a little ahead of schedule, which I think is rather atypical for conferences like this, but I am not sure it is a bad thing. So I would like,without too much delay, to turn the conference over to Bill Mirick who has been working at Battelle Laboratories for about 25 years. He holds a degree in chemical engineering from Ohio State University and has been working on encapsulants for EPA as Larry said for about two years now.

MR. MIRICK: Thank you, Forest. I hope you can all hear me.

I am looking out over the audience here and I think I have talked to about half of you already. Some of you will be getting new information, some of you won't. When I go to these, it looks like I see more and more familiar faces.

I am going to get into some of the basic studies that we did on the encapsulants and the reason we did them and some of our conclusions and what we found out about them.

Basically, when we started looking at materials to encapsulate the friable asbestos, we looked at it as a normal paint chemist would and tried to put some of these on metal panels, tried to discuss the work on abrasion resistance, the flexibility of these coatings, but soon after we got into the program we foudn out that because of the friable matrix, we were working with these types of test were impractical to work with, so we had to develop and work with a test matrix that simulated the asbestos material in the field.

One of the first things we did then was to go out into the field and look for a typical -- and I have to put that in quotes, because I really haven't found any real typical asbestos-containing matrix. The one we used for a base background data was one containing 35 percent chrysotile asbestos and the rest was mineral wool.

We tried to develop a test matrix. We found that the product called cafco bond or cafco blaze shielded CF, most nearly simulated the properties of this asbestos containing material.

Now, the material that we worked with was strictly a mineral wool substraight, and that is what we decided on to use as a test substraight. It had basically the same penetration with water, it had about the same degree of impact resistance.

It had a lot of other properties that the asbestos-containing material had. It had somewhat similar surface properties in the mineral wool as the asbestos-containing material did. So this is the product that we used to evaluate and check the sealants, realizing that there are other combinations and there is a tremendous amount of other materials out in the field that the encapsulants would have to work over.

It is difficult to go into the field and look at a material and say this is an asbestos-containing material and it can be encapsulated. Even after you have looked athte bulk sampling and found that it contained asbestos, you also have to know what other produ ts are there, because each product has a somewhat different surface charge if you want to call it that, and the surfactants and the wetting agents used in these encapsulants may or may not wet these other materials.

You want the encapsulant to -- if you are using a bridging, you want it to penetrate a little bit into that asbestos-containing material. You don't want it to laden the furface and fall off later. With the penetrating, if it doesn't penetrate, it is not doing the job it is supposed to do.

So we tried to develop a test matrix that would work as much as possible on all of these. We found out that the test matrix did not encompass all types of asbestos or all types of conditions you run into in the field. You have to remember that these matrixes you see out there may not be just what was supplied by the manufacturer, by the applicator may have decided when he put it on concrete it has good adhesion, but to steel it doesn't have the right adhesion, so I may add something to it to help it cling better.

When he does this, he has changed the properties of that asbestos-containing material.

In our study we could only look at one test matrix. So this is one of the problems you are going to run into today.

Even though these sealants prove to be satisfactory on that test matrix, they may or may not be on the material you are putting it on in the field. Getting back into the testing, we did then, we applied these encapsulants to this test matrix we used and this is what we did our testing on.

We tried to develop testing on this test matrix. Remember, we are talking now about the friable matrix, the friable material that you can crumble in your hand. We sprayed this on -- the first test was on styrofoam board to give us backing and we tried to determine a few tests that would give us the most logical properties of these encapsulants.

We wanted to find out how much it penetrated or how well it wet the surface of that material. We developed a penetrating test, we pourted the material on the surface of this. This made a good screening test, because some of them, if they wouldn't wet it, it would bunch up on the surface and not penetrate into the material. Or when they dried it didn't have a good thick layer of penetration. Some of them would just lay on the surface, even though they are penetrating materials.

When you first looked at that material, it was wet all the way through. The water in that emulsion was carrying all the way through. Or in the case of bridging sealants, when you poured some of them on after they dried and cured, you could pinch it in the middle and lift that bridging sealant off.

It was not wetting the surface of that mineral wool. Realizing that the penetration test by just pouring it on is sort of false, when we got to the second part of the program we made four by four square foot panels of the mineral wool and mounted them in an upside down position and we applied all our encapsulants by airless spray onto these surfaces.

This gives us now the penetration that is the true that you would find in the field when you are spraying overhead. You have two things working for you and several working against you when you are spraying overhead. The two things working for you is the pressure of the spray, and we didn't want to use a high pressure.

The other is the capillary action and the surface action of the materials trying to draw the material up in there. The force of gravity was trying to pull the material back down. So penetration is determined then by mainly the air pressure and the capillary of -- and wetting these asbestos fibers up into there.

It is difficult, if you have incompatible encapsulants to wet those surfaces, because they are not drawn up by capillary action. This was the penetrating test. These are some of the problems we run into when apply an encapsulant in an overhead position. If you are not wetting that surface because of the surface characteristics of that material, you don't get adhesion that an initial layer of that surface.

If you don't get this the material then falls off in sheets. It may not do it in three or four days, but it may do it three or four months later. The penetrating test we decided on is after the material was cured we would then take a core sample, a corkboard or something that you can cut into the material, go all the way through, put it in a glass vial and put water in it, let it soak for four hours, dump the material out of the vial and measure the hard core that you had of that material.

That seems like a sort of a rough test, but remember, these encapsulants when cured were supposed to be water insoluable so the water doesn't leach out the resin.

So that is basically what the penetrating test, was, how it came to be. We have also tried soaking it for 24 hours to see if we could leach anything out of the water and we analyzed the water. In most cases we found the materials were not leaching out enough resin to give us any problems.

Flexibility of coatings. A lot of these coatings are planned if you put them on steel substraight they have excellent flexibility. The main problem we are working with now is how can you determine flexibility on a substraight that is really not flexible.

It can't bend this friable material like steel over a mandrel. It is too thick to bend over a form of some kind.

You deform the bottom, you don't deform the top. How can you measure flexibility, how much the coating bends? We found out that it doesn't make too much difference how much you do bend that materal. We are not really concerned with the flexibility of the material itself.

We are concerned mainaly with how well it adheres to the surface of that material. If it doesn't adhere, then we have problems.

So we went from a flexibility test to an impact testing where we have a tube with a known weight, we drop it a known distance and it impacts on the surface of the material. We determine how much it impacts in under a certain load and examine the surface of the material and see how much it is broken or bent in.

This is the way we determine the impact resistance of materials. If you take a broom handle and poke it against a ceiling and see how much you can force the broom handle into the material is not a good way, because there is no way you can control how hard you poke with a broom.

It is a good test if you have a calibrated arm and the right sized broom handle, but it is very hard to describe to people. So we tried this impact test, but the trouble with that, we have to cut the sample out, turn it upside down so we can drop the weight on it.

We have not been able to develop a good impact tester that you can use against a ceiling that works upward. It will have to be spring loaded.

After we tried one with spring loading, we found we had a lot of variations, not so much because of the spring force, but because the resistance was working against the force of the spring and it did not give true readings. We hvae looked at these impact tests and the only way they really work and they are reliable is actually to spray your encapsulant on the best substraight or on a substraight that you are going to be using, cut a section out, turn it upside down and drop the weight on it.

It doesn't do any good to do anything else. You can poke at it, prod at it all you want, and you really can't tell the resistance to impact until you do this type of testing.

It has to be done on a friable matrix. If you do it on a metal matrix, it is not true. We have stone chip tests, testing on automobiles, but they dno't want unless you are working with the material on the actual matrix you are using it on.

Another requirement of the encapsulants we felt was very necessary, one, when you had them in a fire they did not release a tremendous amount of smoke. This is a typical thing of a lot of coatings. We don't want smoke resistance. But, again, when we tested them, we got a lot of encapsulants in that had class F fire ratings and low smoke ratings.

This was done on asbestos board, it was done on plywood. As soon as we apply it to the test matrix of mineral wool, we have differences. We have some tested class A, most of them would have a flame spread rating of 10 or 30.

When put on the friable matrix, they go as high as 50. Trying to explain the reason for this was a little difficult. Fire ratings were different.

The smoke ratings were different and the toxic gases released weren't any different. They stayed about the same. So we considered that the material burning was about the same, but the amount of toxic gases did increase sometimes.

Now, where did this problem come from? Well, we finally concluded that the friable matrix because of the type of material it is, it holds the heat. It doesn't let the heat dissipate through like an asbestos or plywood board would.

It holds the heat and you end up heating your coating from both sides of the material. You have got the heat coming from underneath and you have the heat on the surface from your radiant panel test. The biggest problem is that the material in the encapsulants in the asbestos-containing material does not get the oxygen it sees on the surface on an asbestos board or on a plywood panel.

Therefore, you are not burning the gases by the radiant heat, you are creating smoke. So we end up with a larger generation of smoke and sometimes a larger flame spread, because when the smoke is released, you have a false flame front going on because you burn the combustibles in the gas stored under the surface.

That is some of the problems. There will be a lot of materials have class A on the asbestos board and on the pine or redwood panels, but on the friable test matrix will have a lower fire classification. The toxic products that we just analyzed, we didn't do the way I would really like to do. We just pulled them off the smoke chamber and ran them through tubes to give us a gas analysis.

The ideal way would be to put them in a vacuum flask and analyze the flask for all gases contained there. When you are trying to do 150 tests in a short period of time youjust don't have time to do all those analyses. The encapsulations, when we started looking at them, we talked about the penetrating and the briding type encapsulants. Let me define those for you.

Basically, a penetrating encapsulant is going to be low in viscosity. We are talking about most of the time around water thin.

It is going to be fairly low in solids. In other words, may have no more than 15 up to about 30 percent volids in these, sometimes 35, and it generally is non-pigmented.

When you get into the briding encapsulants, those are usually higher in viscosity, higher in solids and usually are pigmented. Now, the briding encapsulants, if you -- the reason we call them -- you can thin the bridging down and probably get some penetration, but basically remember the asbestos material is somewhat of a filtering device also, and when you think a bridging encapsulant down enough so you get real good penetration, you also filter out the pigment onto the top surface of that material and the pigment usually lies within a quarter of an inch from the top.

Once you have the pigment up there, you sort of have a barrier for further penetration. So you can, by good application and careful application with a pigmented material, you can get penetration up to half an inch, but you are probably applying this in three, four, five or six coats, and in the field, this is not too practical.

Bridging sealants and penetrating sealants -- I have been accused of sort of favoring penetrating sealants and possibly I am a little biased in their useage.

The penetrating sealants basically, if they function correctly, will encapsulate each asbestos fiber and you will have something like a matrix like a vinyl floor tile. Each fiber is encapsulated if the penetrating sealant has functioned properly.

Bridging sealants, because of their nature, bridge over the surface. They really do not penetrate and encapsulate each individual fiber.

There are uses, though, for bridging sealants and there are uses for briding sealants. I have some difficulties when you hare large flat areas of a very friable material that I don't think should even be encapsulated in the first place where people have applied a briding sealant to it.

What happens afterwards I don't really know.

I have seen somewhere several months after they have applied an encapsulant that -- where they have applied a bridging on a large flat surface which should not have been encapsulated, the material is pulled loose and you have the material hanging down plus you have a very raw asbestos substraight up there which has been disturbed and you can release a tremendous amount of fibers.

I have seen failures in penetrating sealants also. I will make a statement that I have made before, that I only seen encapsulants being used in 15 to 20 percent of the jobs across the country. There are too many areas where people have tried to use an encapsulant thinking it is a cure-all, that later on they will have problems.

Some of the no-no's for using an encapsulant, whether it be bridging or penetrating, is where you have evidence of water damange and that water damage problem has not been corrected. If you have water damage and you put an encapsulant on and you have more moisture coming through, you have essentially sealed that surface, the lower surface and then you have your asbestos-containing material and then you have the substraight.

Water gets between the substraight and the asbestos-containing material and your encapsulant. The water stays in there now. It has no way of coming through the asbestos-containing material, and you build up a reservoir of water or moisture and you start deteriorating the adhesion to the substraight and then you have a calamity if you want to call it that, where the whole asbestos-containing material, your encapsulant and everything falls to the floor.

Another area where I don't see the use of encapsulants is where you have a friable asbestos material two inches thick or more. It is very, very difficult over large flat surfaces to tie up two inches thick material without some other means of support.

On beams and steel structures where you can wrap around and use the bridging sealant as an envelope where you have contoured surfaces for it to wrap around, it will probably work, because you can create a complete envelope.

But on a flat surface you can only tie into the corners and the edge of the room unless you find some other means of support. I have seen areas where people have put up a chicken wire mesh over the whole flat area and then spray it with a bridging encapsulant and it probably does an excellent job.

Another area where you had great difficulties with the use of encapsulant is where you already have some of the asbestos containing material hanging down in clumps. In other words, the material has already lost its cohesive strength, the strength it has to hold to itself.

Some people say that you can go in and wet it down lightly and push this material back up and then go back over it with your encapsulant. I find when you do this, unless you are using an exceptionally good adhesive that it starts coming down afterwards.

One test developed by ASTM is the use of a gallon jar, where you put on a lid, push up the material and hang a weight on it to see what the cohesive weight is. The original material should have held a two pound weight for one minute.

If you are going to try an encapsulation job and the material cannot pass this two pound weight test for one minute, I don't think you should encapsulate. You may have lost -- there may have been water damage and you may have lost some of the strength of the concrete or the gypsum that was used for binders.

I am trying to think if there is anything I have really missed on those areas. Some of the testing that we have done has been basically on the test matrix. Now, the test matrix is not all encompassing as I explained earlier.

It does not contain fiberglass, blends of mineral wool and fiberglass, blends of asbestos, and there are asbestos materials we are talking about, if we are talking about chrysotile, it has one surface characteristic, whereas the amosite and the crocidolite are different.

So the materials wetting the chrysotile will not wet the amosite or crocidolite. So it is not a real good guarantee that the encapsulant that you plan to use is going to do the job.

I still remember and highly recommend and strongly recommend, I don't know how you want to put it, that before you do an encapsulation job, you do a little test area on the actual substrate to see how well that encapsulant you want to use is going to work.

It is very difficult for me to go in and tell you I have a hand brush test. I looked at the materials, penetrating materials, I can brush hand over the surface, and if it starts knocking clumps loose, I don't feel it has done a good job.

I don't have a good abrasion test for that, I am trying to develop one. It is hard to tell you how much hand pressure. When you spray a penetrating material or some bridging materials, if you can run your hand over the surface at about the same pressure you would use to hold a five pound weight in your hand and you knock clumps of material loose, that encapsulant has not done its job, no matter how well it has penetrated.

Sometimes on bridging sealants, even though there is a thick layer of briding materials, if you can feel something moving under there, you are probably finding out that the briding material has really not wet that surface. It is just laying on the surface and after a while it is going to probably come down.

Granted it is not a very professional or scientific test, but it is one I think you should look at and consider, that if you can knock stuff off with your hand, your encapsulant hasn't done a good job. Or one of the other ways, and I don't like to do it because it gives other people ideas of how to destroy this material, but if you take a knife and cut a slot and put your finger in it and pull down a little bit, if you feel the whole thing starting to pull down, again, you have not really wet that surface.

We have got 10 of the encapsulants we looked at out of the 150 that proved to be acceptable on the friable test matrix out of 150. All of these that have proved to be acceptable have passed all of those tests and are pretty well described.

They do wet -- the briding sealants we have worked with do wet into and do penetrate into the asbestos materials, some of them up to a quarter of an inch.

We talk about thicknesses of bridging material, we are not talking about how much of that briding material we have put on. We may have put on only 25 mils of the actual coating.

The resin has penetrated in and we have a 3/16 of aninch thick non-porous good tough film in there where the resin has penetrated and tied up in the asbestos matrix. One I sprayed that I remember, a bridging encapsulant, looked very good and everything.

We sprayed it on the test matrix, the four by four foot square. We took the material off, left it in the rack overnight on our upsidedown rack overnight, came in the next morning ready to move it out and move another one in and the whole thing was laying on the floor.

It did not wet the surface of that asbestos containing on the mineral wool in the material. And you can run into those problems in the field.

I think now -- probably the easiest way to do, if you have any questions, I think the best way, we can probably get more information out by asking and answering questions than any other way that I can explain what we have been doing on our tests.

VOICE: Could you further explain that two pound test? In the area that it encompasses? In other words, how large an area?

MR. MIRICK: What I do is put it on at least -- it is a three and a half inche, three and a quarter to three and a half inch gallon can jar lid. I put it up there so it is at least a foot away from any corner or anything like that.

In other words, just a gallon jar lid that we fasten to the sealing.

VOICE: You said you used urathane?

MR. MIRICK: Two component urathane as an adhesive to hold it up there.

VOICE: You have got that cap weighted for two pounds?

MR. MIRICK: No, I just have a hook in it at this time, and I let it cure, let the urathane form cure and then I hold the weight -- hange the weight on it afterwards and time it for a minute. With some of the encapsulants, I was available to hang up to 175 pounds of weight on that for a minute without it falling off, but those were some very outstanding encapsulants.

Does that explain your question?

VOICE: Yes, sir.

MR. MIRICK: It is an ASTM test. In the handout you got today it is on the back page. It lists the ASTM number.

VOICE: 1036.

VOICE: Have you done any tests with penetrants and bridging encapsulants together, in conjunction?

MR. MIRICK: I have not. I understand some people have been using these. I have not done any of that actual work, no. I was evaluating basically the individual sealants, not systems.

VOICE: I am questioning the method of arriving at classification where you pull some penetration types and some briding types. You can't go by pigmentation solely because some of these products have less than one percent pigmentation and if they are not pigmented, they can behave --

MR. MIRICK: I agree with you. You have to look at the way they act. I am saying in general the penetrating sealants are low viscosity, low solids and non-pigmented. I am saying in general. There are a few that we had that we had very low pigmentation in. I am not classifying those as bridging sealants.

VOICE: The method of the test, taking the material as is without regard to its let down procedure, its method of application is highly erroneous. You can't consider something by looking at a penetration core by putting a liquid on there if you don't have the wetting action or viscosity.

You have some acceptable sealants here that are ten percent solids, 90 percent water. There are other sealants higher in solids that could give a better money value in terms of application if they were reduced.

You have to consider the properties of the material -- you just can't consider it as it is. I take exception to this only by it was classified as being marginal.

I have evaluated the competition, I looked at what these products were and what they were composed of and how they behave and they take exception to the fact that they were not treated equally.

You cannot take something at ten percent solids and compare it to something 50 percent solids and say one penetrates and one does not.

MR. MIRICK: We applied the encapsulants, we applied them by airless spray. We reduced them to the manufacturer's specifications that were given to us. Then the penetration was studied by the actual situation where they were airless sprayed and applied overhead.

That is the penetration reported in those reports. Your viscosity, if you wanted it thinned three to one, that is the way it was thinned. If that is what was reported to us, that is the way it was thinned.

If it was not reported to us as being non-thin, that is the way we applied it.

VOICE: In the future when you are working now with the ASTM people with their new guidelines, are they going to try to equalize the solids content as being a factor? Is this going to be a consideration?

MR. MIRICK: That is a very difficult consideration to make to determine any paint or coating or encapsulant --

VOICE: In terms of what the resulting film will be. In other words, I have seen a two and three application process of a competitor that will remain unnamed that is considered acceptable. But the material has no reciliency. You could actually take your finger and disrupt it because it is running at eight, nine percent solids. Two applications at nine percent solids is literally a no deposit film.

You are not going to have a recilient coating that will prevent inadvertant contact and subsequent loosening of the material.

Water sensitivity, I have seen films that are considered to be acceptable that I know are water re-wettable. These films are not water insoluable. I would like to know what degree emphasis was placed on determining that degree of insoluability.

MR. MIRICK: After we sprayed the material, we took the core sample and put it in a glass vial for four hours and 24 hours. But again, to try to answer your question, if we base thins on percent solids, it is very difficult to say that something -- I agree with you to many degrees, that if you have something that is 20 percent solid and you put one coat on you have a lot better than if you have something with only ten percent solids.

I have no disagreement with this. But if you look at 100 different materials or 150 different materials, and you reduce all those down to the same percent solids, you start with one that has 8 percent solid, that is all it has when it is reduced down the way they recommend to reduce it down and you start with one at 50 percent solids, you are going to reduce some of these things down so much that they are ineffective.

VOICE: I happen to know that my product was not utilized according to the directions, so when you get flame test runs, how much residual fuel is left after evaporating of the solids. You will have 50 percent more residual resin left there to burn with 50 percent.

If you have something at 10 percent very little smoke will be generated and very little flame, because you have less fuel. These are other considerations.

MR. MIRICK: I agree. If we try to put everything down to one solid or bring everything up to one solid, with 150 products it is almost impossible to do.

VOICE: I think you should have a minimum solid requirement.

MR. MIRICK: That I would consider, yes. I would definitely look into that.

VOICE: I would like to ask a question on a different subject. Has Battelle done any work on measuring reducing the asbestos from the sealing with encapsulants?

MR. MIRICK: We hope to get into the area of doing some abrasion tests and breaking off some fibers, not only on the surface, but down in the middle of the material and look at them under the electron microscope to see if they are encapsulated in the case of penetrating material, whether they have a resin core or not.

We havenot had a chance to go into that complete area. Basically what our work was doing was look at these materials, whether they release toxic products, whether the amount of smoke they generated, the flame spread resistance and whether they were forming a good surface barrier at the time.

That is basically all our work was doing.

VOICE: There was a remark that you had made as to terms of friability and where you used in your testing procedures approximately 75 percent mineral wol to balance the chrysotile. I got the impression that this, in your estimation, was representative of what was being experienced in the field.

MR. MIRICK: I would not say it is representative, it is what we used as our basis to try to form a matrix. It was 35 percent chrysotile.

VOICE: And the balance mineral wool?

MR. MIRICK: Yes.

VOICE: Was this classified as friable?

MR. MIRICK: Yes.

VOICE: My idea of what friability means is it appears to be solid, like volcanic rock but you can crush it and it turns into a powder. The process of 65 percent mineral wool and chrysotile asbestos doesn't evidence that.

MR. MIRICK: This was one of the big problems we had in determining what friable is. Friable is where you can take your hand and break the material loose. It may not crush into a powder, but by brushing your hand over it or by rubbing over the surface, you can knock the material loose.

VOICE: I think we have done well over several thousand x-rays analyses, our concern was the other matrix in the mass. I have yet to find one similar to the other. We found this in gypsum, but rarely all mineral wool.

MR. MIRICK: We had to develop some kind of a test matrix. We took one -- that is also where we did our field studies, so we had -- our test matrix was similar to the results of our field study as much as possible.

VOICE: Another question, where pigmentation --

MR. MIRICK: Could you have the speakers identify ourselves?

VOICE: I am Ed Drasca with the KRC Research Corporation.

The object of a bridging coating where pigmentation, more emphasis was being placed on this, as to the normal routines of pigmentation to vehicle, the vehicle being the actual binding polimers that are involved is generally around 22 percent.

The balance is pigmentation and extenders, which there is generally a large amount of in our analysis of it. The fact of a reduction of this down so you can maximize penetration, you are reducing the polimer materials down drastically where the cohesive and the adhesive strength of the material has been reduced to a non-functional basis and thereby reducing a bridgeant nature of this material down to this point has its disasterous effects.

MR. MIRICK: This is true, and this is one of the reasons why I am trying to bring each encapsulant down to a certain solid only. It would have to be a resin solid, not a total solid, and you can destroy the effectiveness of bridging sealants because of this.

VOICE: I also think the criteria for your tests can be objected to strenuously in many ways. It is not your responsibility to determine the solids on a manufacturer submitting you as a product for testing. Your responsibility is to base what they state they feel is necessary to effect these ends and not to reduce the solids down to such a point that the material will be effective or non-effective.

MR. MIRICK: Our task was to evaluate commercial products as submitted to us, using their recommendations for the application of it, if they wanted it thinned three times, we did that.

On the test substrate that is why we gave them the basis of a satisfactory or marginal type material. We were applying it as we received it from them according to their instructions. In several cases we had some of the manufacturers actually come in and apply their material for us while we observed it.

If they wanted to do that we had no objection to it. But again, I would like to say, if you think some of these bridging coatings down so much, ten percent reductin sometimes can ruin the cohesive strength or the strength of that bridging encapsulant. It just doesn't have the impact strength, it may not even make a good film sometimes.

It may be a semi-porous film sometimes by reducing it down ten percent. We did it to the manufacturer's specifications.

Now, if we didn't do it to what they specified, that is our fault in the sense that either somebody didn't communicate with us or we misinterpreted what they sent in. In one case we did this.

They sent in a fact sheet where they said to reduce it seven to one, but they meant this is seven to one for a miscoat first and later on in the folder, about three pages later in the folder, they said it should be reduced only three to one.

VOICE: Would this be the general rule, that somebody would be putting a product out on the market place with the objective that the contractor or the user would have this requirement to dilute it with water?

I think that would be fraught with a lot of --

MR. MIRICK: There are some that they do recommend being reduced, yes, sir.

VOICE: I don't think that is beyond the technical ability of an applicator to apply material until you tell him to reduce it to get the proper penetration viscosity. I am not talking about reducing pigmented solid, shocking the system, we are talking about simple ratios, like two to one, and I don't think that is difficult at all.

VOICE: It isn't difficult, but there is a grey area that could be deceiving because if a contractor bids in he will throw a half a gallon in so he can make a profit on the job.

VOICE: We want to give him a dollar value. If we want to supply water we will give him a ready mix viscosity on the job and we will end up with practically no solids.

VOICE: I think that would be a more practical way.

VOICE: Does the mineral content or processing of the water prior to dilution have any effect on the product?

MR. MIRICK: I want to get your name.

VOICE: Ron Morel. Assistant Superintendant from Manchester, Vermont.

MR. MIRICK: I have not seen in too many applications where you are reducing a paint down where the mineral content of the water adversely affects the paint. I don't know of any paint manufacturer that is using distilled water in their letdown of the paint, so I don't think you really would have that.

They are using regular city water. I don't know if it had a sulfur content it might give a little different smell, but I don't really see any problem in a paint formulation of just using regular water.

VOICE: Toincrease the effectiveness of a penetrating seal, wouldn't there be some emphasis on the fact of reducing the lewis micron size or the particle size of the material as well as adjusting the liquid of the acqueous phase by using floro penetrants reducing the dine factor to normally less than what normal surfactants do?

MR. MIRICK: Yes. I feel if somebody really wanted to there are a lot of formulations that could be worked out that will do a much better job of wetting asbestos material in a lot of current products out today. I think it can be formulated, I think a good product can be made, and you can keep your solid content up to around 15 to 18 percent and do a much better job of binding it.

VOICE: Much higher in solids?

MR. MIRICK: Possibly much higher. Some of these resins we are talking about, when you apply them with airless spray because you apply them with high nozzle pressure, you are getting a lot of sheer and you sometimes break down the material and get better penetration just because of the sheer that you got under the resin.

It helps it penetrate.

VOICE: There is another point. I don't want to dominate the conversation, where you had indicated hangars were present -- there was apparently a sheer factor to the asbestos not completely severing itself because of the poor interface adhesion between the substrate and the asbestso matrix, but the sheer factor that had lessened its cohesiveness and adhesiveness on the surface characteristics, which would indicate that complete removability would be preferable situation.

We found that using a high velosity vacuum with a three inch hose to take off these elements from the surface, not completely, but down to a relatively sound surface where the adhesive and cohesive qualities were adequate for encapsulation proved to be an economical --

MR. MIRICK: I would have no objection to this. My main objection to this when we spray it on that they don't remove it or they try to put it back up there. You can go ahead and remove that poor cohesive surface or the one that has already deteriorated for whatever reasons, you remove that and get to the solid matrix, I see no problem with putting an encapsulant on it.

I would rater hang the weight on it after I did the vacuum cleaning to make sure, but I see no objection if you can get that friable or loose material off the surface before you put on encapsulant, I would have no problem with that.

VOICE: Joe Martin.

Could you clarify one point for me?

In your earlier staement about the ASTM test of pulloff, you are not saying that that is a sufficient test to evaluate the overall performance of an encapsulant in the field; are you?

MR. MIRICK: No. That is just one method of determining whether the friable asbestos containing material can be encapsulated. If it fails that test, I don't think you should encapsulate it at all.

You have so little cohesive force there that can't even take basically a two pound weight over you are talking about 14 ssquare inches of space, if it can't take that, that doesn't have very much strength.

When you put a coating on there, you are not adding an awful lot of weight. A typical -- probably a bridging coating would weight at the most 16 to 18 pounds a gallon if you got a pretty heavy one, pretty heavy pigments in there, and you spread that over 30 square feet, you are not adding an awful lot of weight to that surface, so we are not concerned a lot about the weight of the material you are putting on there.

What we are concerned about is that weight and the water from that penetrating in through there when you are applying it.

The water will penetrate, but the resin may not. Now the water is wet through, now you have a wet, very friable surface matrix.

Now that little bit of weight of that encapsulant is enough to pull it loose a little bit.

VOICE: If you get a positive result would that indicate that further tests would be required?

MR. MIRICK: If you used the cup test or the weight test to see whether you have got cohesive strength, that is nly one test. Yes, if the asbestos matrix past that can support that, I think you should run a trial test or your encapsulant on the surface to see if it wets that surface. If it doesn't, there is no use putting the material on.

VOICE: How can that determination be made by non-informed people in the market place, the wetability?

MR. MIRICK: The wetability is a very, very difficult factor. If I could come up with a good test of that I would be a lot happier.

I really don't know It is an objective type of testing, because I look at the surface and lift the corner and see if it is wet. If you get a sealant that hasn't wet, after you pull it off and look at it, you won't see any fibers along that surface at all.

There is a few in there from mechanical adhesion, where they have been wrapped around, but usually the surface is almost smooth, there are no fibers clinging to the surface, so it is not wetting that surface.

When you don't wet a surface and you put a material up there, it is not going to stay. I guarantee you that.

VOICE: When you are doing this testing have you come up with any overall common denominators between penetrating sealants or bridging sealants? I am trying to get at, when the federal government, for example, buys coatings or paints, they have specifications which work from the constituent components to the performance as opposed to performance back to how the manufacturer made it.

When you are testing allk these products, have you come up with any common denominators of viscosity, suspension materials, whatever it might be, so that the manufacturers may have a better guideline as to how to make their coatings fit those parameters that make it work?

MR. MIRICK: No. I have not. Because of the different resins used, it is hard to say they should be of this viscosity, have this percent of solids in them. You have to look at the material, how it attaches itself to the asbestos-containing material, how it wets that substrate, what impact it has, what resistance it has after being on the substrate.

I have seen emulsions that literally break after applied. You get coagulation on the surface. I have some put on steel that look beautiful, and they don't cure. I didn't try to find out where this one didn't cure. After ten days it was tacky.

VOICE: I think it is incumbent on the manufacturer to make the determinations. If he cannot demonstrate the astuteness to see the physical problems and the chemical problems and the chemistry of it all, then he shouldn't be in this damned business.

MR. MIRICK: I think I have to agree with you. Our study was not to determine what a good formulation was. It was not to determine what the best product was. Our basic idea of this was to come up with a series of test methods or at least give the manufacturers some indication of what tests or what procedures the encapsulant should coform to or should meet to be a viable material to use on the friable test matrix.

VOICE: You also indicated I think in your report, recalling, it has been so long since I looked at it where the polimeric substances were the vehicles being used. Was this an identification --

MR. MIRICK: Just as an identification; that is correct.

VOICE: Was this identification initiated by Battelle or was this submitted by the manufacturer as to what the nature of the polimer was?

MR. MIRICK: It was submitted by the manufacturer.

VOICE: There is no way that you can make a determination of this?

MR. MIRICK: No.

VOICE: I would like to make tests on that --

MR. MIRICK: I would, too. I would like to see if some resins wet the asbestos material better than others. I have a feeling that some would, but I have not done that. Again, I hate to say, but funding is critical too, and you have to do so much with a certain X-number of dollars and you are sort of limited to what you can do in lots of cases.

VOICE: Don Swann of D&E Engineering. What will latex paint do when applied to that test patch that you have?

MR. MIRICK: Latex paint, quote -- a lot of these encapsulants you could also classify as latex paints. What we are talking about is a sealing paint or a wall paint formulated for interior work. If you put these on the friable test matrix, in 99 percent of the cases that I have seen you will not get a continuous film. They are not made for that tye of rough textured substrate.

Besides, they have poor impact resistance. They are low in resin content and pigmentation.

VOICE: I have probably looked at a couple thousand of schools, and I have gone back to contact numerous amounts of them and I have found out that a lot of them are going ahead and painting their ceilings. It has been an irritation to me because I am required to go through all the procedures and basically keep quiet about the schools that choose to apply latex paints.

MR. MIRICK: I don't think that latex paints over any friable matrix is going to do a good job.

VOICE: How much will that impede the penetration of the sealings?

MR. MIRICK: It will do a tremendous job of impeding them. You now have a surface that may be 80, 90 percent covered. You have only little pin holes or little areas for the other material to get in.

VOICE: Is EPA going to issue anything to the school systems that they have contacted with these dockets that they should not, and is it in any violation of any federal law?

MR. MIRICK: I don't know if it is in any violation.

VOICE: We were talking about latex paints. I have looked at a lot of schools, and they know what they should do according to your dockets and they go ahead and apply latex paints. This gentleman said, yes, it will impede thepenetration of the sealants and is EPA going to contact them and basically tell them not to apply latex paint on the basis of this man's recommendations or information that, yes, it is not going to last?

MR. DORSEY: We have been providing the best technical information we have on sealants and paint. We have many questions about latex paints. We recommend if they do have a problem, if it is a friable material and there is a problem, that they test whatever material they are going to use and we have not recommended latex paints.

The only case where they have been used and we have a comment to that effect is areas where it is not a major problem. By major problem, highly friable.

It may be a granular surface. Many of the hotels around the country have this material and you see where they have painted over many times. You are going to have a problem in the future, but we will not recommend a specific compound or a specific encapsulant or sealant to anyone.

We provide these tests. I think Bill also should state that when he started this program, what had happened, he contacted most of the major manufacturers and said that we are checing on materials that might be used to encapsulate asbestos containing maerials.

If you have something, send it in and we are going to begin tests. This matrix that was developed, it wasn't done previously.

Bill learned a great deal from this progrma. Basically, these were formulations that were probably on the shelf and were sent in to be tests.

GEnerally, we are not recommending latex paints or anything. The tests that have run probably are just a start, preliminary tests. One of the things we hope to derive from this conference is share with you your knowledge. We should be in probably the second or third type of paints and coatings and sealants that are being used now.

We are only testing water based compounds, primarily because of the determined toxicity problems with other compunds. Maybe latex paint should be tested more. I don't know --

VOICE: It is not that I want to use them, it is just I see evidence of numerous school systems doing it.

MR. DORSEY: I share your concern. Many school systems are spending a great deal of money buying latex paints and maybe other compounds that haven't been tested and it is costing a lot of money and they have not solved their asbestos problem or maybe they didn't have a problem that warranted that in the first place.

VOICE: I go into a public bid situation. I find I am bidding against a painting contractor who is basically going to get hold of one of these materials and apply it like they would apply latex paint without any of the procedures outlined in your dockets.

VOICE: I think the problem is not too much its strength factor, because there are many latex paints that will demonstrate the qualities we are looking for. THe big element that demonstrates the weaknesses, the latex paint being put on a substrate that withdraws the acqueous phase by capillary action.

The paint will not coalesce properly to give a balance of properties necessary to effect the given results. If it doesn't coalesce properly, and these were withdrawn very rapidly by highly porous or observant materials, the effectiveness of the paint is thereby reduced to that extent. Since there are so many variables involved over many thousands of x-ray defraction analyses, we have yet to find one similar to another in quality or quantity of materials being used.

MR. MIRICK: I have to agree with you on the latex paints. That is one of the problems, they do not coalesce, the moisture is drawn out. It may not make a continuous film because of that.

VOICE: I have a comment sort of related to this gentleman's comment about the inappropriate types of materials that he has found used in school buildings. I am Norma Scholneck with Essex Chemical Corporation.

First of all, I wanted to ask, relevant to the identification program Mr. Dorsey alluded to at the beginning, we didn't have an opportunity for questions then, are you going to be considering providing some sort of guidance in this identification program? You said no corrective action would be required, only an indication.

Will there be some sort of guidance in terms of planning towards a corrective action stage and has EPA considered the possibility of providing guidance in terms of choice of appropriate versus inappropriate materials?

I know you have a guidance document out, but you know, when something doesn't appear in the Federal Register or doesn't appear as an official type of document, it doesn't have the stamp that carries with it a certain amount of weight from a legal standpoint.

I just wondered if EPA is thinking in that direction, because obviously there are many circumstances that we are all aware of where inappropriate methods, cheap materials have been used.

Responsible manufacturers, I am sure many of them are represented here, are quite aware of the fact that there are people who will outbid them because they have irresponsible methods and marketing practices and scare tactics and who will not investigate a test properly.

Is EPA going to make recommendations about looking into appropriate versus inappropriate?

MR. DORSEY: If I can remember your questions, the answers are yes. Let me step back.

The identification and notification is needed now because we know this asbestos material is being disturbed. We know that people are disturbing it and don't realize they are dealing with asbestos.

They are creating exposure problems. The abatement rule that was planned, we backed off because we don't have a standard whereby we can tell somebody they have to remove the asbestos or that corrective action is required. We have developed now this algorithm that is going through changes and further testing.

We have major programs on the way now in developing the exposure assessment system. There is a program with the Houston schools, a long-term program, EM, a very expensive program. It is purely a research program at this point. We are providing the best information we have, realizing that it is basically research at this point.

The identification notification rule is necessary. The guidance documents will be used. The regulations do require that the person using or the person that will be surveying the school will be using the guidance documents. We don't have a problem saying that this is the kind of material that you survey for.

THis is the type of analysis you ask for. THis is a list of labs that have successfully performed on our round robin program. We don't have a problem there. We can also provide the warnings.

We can take you to that point. The next point as far as corrective action, it is difficult to go into a building becaue you encounter difficulty, different situations to say that may have to be encapsulated. Bill has learned a great deal.

We have learned a great deal just testing these various on the shelf products. We have discovered that there is an indication that maybe the materials will respond to different -- maybe the encapsulant will respond to different types of materials.

It might be in response to the composition of the material as far as the type of asbestos, maybe the types of asbestos, maybe the filters that were used, et cetera. So difficult for us at EPA to provide firm guidance other than our recommendations and what we have assembled from the experts.

I am sure people in this room have had more experience with encapsulating agents that I have. I can tell you horror stories. We want to limit the use until people discover how to use them properly.

If you use an encapsulating agent that appears
to be successful today, how long will that hold up?

VOICE: Is this going to be published in the Federal Register and if so, is there going to be advance notice of proposed rulemaking?

MR. DORSEY: The proposal was last September. This would be the final rule.

VOICE: And it will be published in the Federal Register?

MR. DORSEY: It is planned to be published in the Federal Register. There are copies available. We are going through for agency review now.

We have tried to widely distribute this regulation for comments. If you have not seen a copy, you certainly may get a copy now. It basically tracks with the first four or five chapters of the guidance document.

VOICE: Was this the September 17th one?

MR. DORSEY: Yes. The only difference in the guidance document, we use the term management system and by that we mean that once you have identified asbestos in a building from that forward you have to track what happens to that material.

So you set up a file and a management system for that material. Does that answer your question?

VOICE: Yes. Thank you.

MR. MIRICK: Another part of the question, we are also trying to work with the ASTM to determine standard tests and procedures for evaluating various encapsulating materials. This does not prove that when the manufacturer put them out, because there are a lot of -- I have a problem with poor quality paints that are on the market today, even though they perform to ASTM standards, they are still poor quality as far as I am concerned.

VOICE: One thing I want to say, both of you gentlemen, you speak to the fact that you are providing guidance and help and assistance through ASTM, you will provide further guidance for people who contact you. What I am saying is that there are a lot of people out there who are making decisions about what they are going to do with their individual school buildings who don't contact you, who don't look to the guidelines.

Obviously if they looked to it you have tremendous technical expertise available to offer to them, but what about those who don't ask and make the wrong decision and the consequences of their not asking?

MR. MIRICK: I don't know how to answer that. How do you get the information out? When the program started EPA had an asbestos coordinator in each region and they also trained engineers and architects to work with these asbestos coordinators, to visit the schools tring to get this information out.

I am not saying that they -- I think they have done a good job in trying to do this, and each one of those asbestos coordinators, by the way, went through a special training program. Each one of the people working with them went through a training program, so they had the knowledge as up to date as we could get it and we tried to get the information out.

VOICE: DER seemed to be taking on a certain amount of workload. It has been disbanded. At least in Pennsylvania.

They have done a lot of the qualitative assessments in the school systems. I know for a fact that in several of the states that the inquiries that came in the back of thse EPA dockets are packed in boxes in the administrative offices or former administrative offices of DER.

I had a few superintendents ask why they had not been contacted by agencies that they had submitted information to pertaining to their sealing.

MR. DORSEY: One of the rasons that we are developing a regulation is because our voluntary program of providing technical assistance has not worked in every situation.

The impact I think has been tremendous, but we have not hit every school.

I have been to many states. I have talked to -- Ican't begin to tell you the number of associations that we have been involved with, just educating them to what we have available to provide assistance if they want to deal with their problem, but there are people making decisions without the guidance documents, without contact with us or anyone that had been involved.

In many states we have experts I think that have provided just tremendous help and guidance in their respective states. There are a number of states and local education agencies within other states that have not worked with us. So I think through the program and contacts we have developed a network of experts around the country that are doing a good job, but we haven't hit every school.

If you know of districts operating without guidance documents or without our help, if you would contact us or a state person, we have ten regional offices listed in the back of the guidance document, contact that person and they will call the school and provide them with the document.

We have an association of retired people where we have individuals trained in the program and they can travel to the districts. It is difficult to provide you with the best information for conducting an exposure document.

Our difficulties are giving guidance on what action should be taken if any. Fifty percent of the time we say don't take any action. At this point you don't have to do anything.

Fifty percent of the time we try to encourage people to remove the asbestos or encapsulate it or bury it. It is difficult, because it is still a research program.

VOICE: My name is Bill Russell with Pentagon Plastics.

The first basic job was done in 1976. My question is, the EPA has done a lot of testing, and it should have somewhat guidelines themselves as far as materials and it seems to me that a lot more time is being spent, time, money and attention being given to develop new products for asbestos for the encapsulation of it, rather than on some new products, whether it be bridging or penetrating, that have performed properly.

The money and the attention that we have spent is looking for products, and very little time and attention is being spent on what has worked and has proved successful.

I would like your opinion on that.

MR. MIRICK: I have a tendency to agree with you. There are some products that have been used and have some pretty good track records. My program essentially has been over since last September, and we are working on the final report -- that has now gone through some revision and things.

MR. DORSEY: I don't think if we have a research program in the future that the emphasis will be on product by product, and I don't think we have products that can be used in every situation successfully. What we are attempting to do, the emphasis in the next phase, I hope, and that will be another part of our discussion, what we would like to do is develop two sets of protocols. One set is for you if you have a product that you can go out to a standard testing lab, have these series of tests run, basically the tests that Bill has conducted to date on the various products, if they perform satisfactorily submit the data.

The second protocol will be an actual test patch on the actual substrate and develop protocols for that. Because what we are finding is that there is an indication that the various materials out there that have to be encapsulated, that the encapsulating agent is responding differently to the products.

You don't know until you actually apply it to the substrate that you are attempting to encapsulate.

The emphasis will be on trying to find something that works, providing the best information to school boards and administrators so they can make a decision. It may be a new product.

We are not in that business. At EPA we are not in the business or promoting or testing products, per se. This contract with Bill was actually an attempt to develop various tests for these potential encapsulating agents and when the contract went out, Bill called the various manufacturers attempting to identify potential encapsulating agents, but we are not in the business of testing various products or promoting products.

We are trying to provide some guidelines and assistance to the school board member or the school district to make a decision on what is the appropriate method.

It is trying to develop techniques and information to get to the school board.

VOICE: This is why in many cases a lot of latex paint has been used, because there is nobody, nobody of -- no committee to say yes or no, and we have had suade shoe salesmen or whatever it may be to go in and try to encapsulate something that has no fiber at all, and there has to be a form of body to help the public to say yes or no or maybe.

MR. DORSET: We are working with ASTM. I think that would be the appropriate group to develop those guide-lines. It might be easier if we found that there were products that were successful in every case.

We haven't found that. We are trying to provide information so that schools don't lose their monty working with what we say is a non-problem. But it is difficult.

VOICE: Mr. Dorsey, may I ask a question? Unfortunately, this information is not disseminating down to the people that have the problem. Essentially, anything -- I have in the last ten years, but since Mr. Mirick's Battelle tests came out, the responses generally were, is this approved by EPA or Battelle. They never read the disclaimer.

I told many of these people that inquired about this, that EPA doesn't guarantee anything. Correct me if I am wrong in this.

MR. DORSEY: No. You are right.

VOICE: And I am sure Battelle Labos doesn't guarantee. They are suggesting to people that we have tested under this criteria and it is up to you to confirm whether this is suitable to your situation, but unfortunately, this is not being disseminated down. When I mention to these clients, did you read EPA's disclaimer in this, they say we never saw it.

I think there should be more information put down to the people at this level that there are no guarantees on the part of EPA or Battelle as to the outcome, because this has been already confirmed with Battelle's materials have been tested that had failed in the market place and it is qualitative judgments that are with the people.

MR. DORSEY: I have to agree. We are attempting to disseminate that information. We have the procedures guidance documents plus Bill's reports, but they haven't reached all the people they should. Everyday we write to people and say you are not on an EPA list and we do not have legal authority and we are not in the business of certifying products.

It is a difficult situation. Anyone here that knows of a situation where someone is saying this is an EPA approved product, let me know. I will write the letters to correct the situation.

People that are attempting to deal with their asbestos problems in the schools need better information. I agree with you there 100 percent. And we are attempting to get that information to them.

I wish we had more definitive information to say yes, in this case you can do it, in this case you can't. All we can do now is make the disclaimer and publish the research findings that we have.

VOICE: You talked about how EPA's job is really to disseminate all of this information down to the school people, and it makes me wonder why EPA hasn't essentially done away with the asbestos regional coordinator's position, at least in our area.

MR. DORSEY: We have sponsored from the Office of Toxic Substances for the last two and a half years one person in each region to act as a coordinator for the program. That function at this point is being transferred to the enforcement office, because we are anticipating that one regulation will be in place. It can be or could not be.

VOICE: You realize how long it takes for us to learn all the information that we have learned through all of this, and all of a sudden we are faced with a new person, almost a technical community that has to retrain.

MR. DORSEY: In region IV, the latest information is that Brown will probably be the enforcement type working with you. In most of the other regions it is the same person.

With our program we are training many different people. The asbestos coordinators were the only people trained. We were learning as we were disseminating the information.

But I don't think it is the kind of program at this point that only one person in the region can work with this. I want to put multiple people in a region, as well as the state people.

VOICE: It seemed like it was winding down.

MR. DORSEY: In the EGPA region there will be an enforcement group that will take over the function of providing the technical information.

VOICE: Robert Roe, Commonwealth of Virginia. I am an architect.

Your directives and guidelines seem to point only to public schools. Are you concerned with anything else, like nursing homes, hospitals, colleges, other public places?

MR. DORSEY: When the program was announced, the school program, we were actually petitioned by the Environmental Defense Fund to respond to a specific problem in just schools. In our survey we found more of this material in school buidings than we did in any other type of building. The information and guidance document is appropriate for any building.

If we receive phone calls or someone solicits help, we provide it. But the focus for the program has been school buildings in the past.

VOICE: Your asbestos regional coordinator, is he only connected with public schools?

MR. DORSEY: No. He can provide the document to anyone that has an asbestos problem.

VOICE: There is one for Virginia?

MR. DORSEY: Region III has a coordinator, Pauline Levin, in Philadelphia.

VOICE: You say soon there will be not just guidelines and proposed regulations and good ways of removing asbestos, you said there will be a law soon?

MR. DORSEY: No. The regulation currently under review at EPA, as it stands now, it requires just identification of the material in the school buildings and then a management system established so that it provides warnings to the workers. It will not require any corrective action.

VOICE: Do you know if there are any states that are proposing legislation that will require the removal?

MR. DORSEY: Yes. Florida has an act. Hawaii is initiating legislation. Most of the states that have strong programs have not gone through their various legislatures for laws. They are conducting a program through, say, a health department, education group, et cetera.

VOICE: So states are concerned about the removing and saying that they are initiating laws, but the federal government is not; is that right?

MR. DORSEY: At this point, no.

VOICE: Is that where the initial scare came from, the federal government?

MR. DORSEY: No. This probem is not a new problem. Since about -- let's see, the first paper was '77 that was identifying the problem at Yale. Then at Mt. Sinai, researchers there did a study of the New Jersey schools and published a report, that they surveyed schools in New Jersey and projected that ten percent of the schools contained asbestos.

In a number of these schools the material was deteriorating and it was a condition where some action should be taken. That was in '78. We were petitioned to regulate the problem and in our investigation we discovered a number of school people were trying to correct an asbestos problem without good information.

But you had states like Massachusetts that had surveyed their schools and removed the problem. Rhode Island, also.

I hope that it hasn't been our posture to scare anyone. In fact, what we have been trying to do in many situations is calm people down so that they don't deal with what we say are non-problems. Just because asbestos is in a building does not mean you have a problem.

We have been working with the various states, we have a contact in each state to provide whatever information they need to help them with their problems and also conduct various aspects of the research program to support the technical needs.

The research with sealants is one aspect.

VOICE: I personally feel that is a real problem, and there are others that have used such phrases as what are you trying to do, insure good health to everyone? Is asbestos really a problem like that? You can't insure them against everything, every problem that is going to attack them in their lifetime.

But I just wish that there would be some guidelines, directives or laws to get rid of the problem, either from the federal government or from the states.

MR. DORSEY: We are attempting to do that. You have to identify where your problems are located before you can correct them. The identification, notification rule would do that. At this point, even if we were in a position to write a rule today, there is some question if we could have a standard or if we have the tools necessary to identify all the problems or differentiate between the materials to determine which ones have to be removed, which ones can be encapsulated or enclosed, et cetera.

I don't have the answers. Within another year we hope to be closer. There are various people speaking at the conference today that are in the same type of business.

It is a very difficult problem for us.

VOICE: The identification notification, that is only going to be for public schools?

MR. DORSEY: Public and private, yes.

VOICE: And that is a small percentage?

MR. DORSEY: Yes.

VOICE: Not too long ago, four very large municipal buildings in a county closeby, in which we had contact and we were talking with them, it was let to a pennies per pound point contractor. We talked with him and asked him to use our material or some other widely tested and used material, why are you going this route? We know what the guidelines are, we don't care. It is not law and we will do basically what we please.

Being a participant in events in those municipal buildings, I am not real thrilled about that.

MR. DORSEY: There is an OSHA regulation for work with asbestos that has to be followed. We are concerned about other buildings and we anticipate collecting the data and information to determine -- you realize it is very difficult on a national level to write regulations that are appropriate throughout the country,and it requires a great deal of information and data and the administrative and legal process is quite lengthy.

We are looking at other buildings. We have a very, very small group of people working with us on the school asbestos program. We are trying to tackle that problem first.

As we develop better technical data and information we will move to other buildings. The data and information we have in the guidance documents are appropriate for any building and provided to anyone on request, but there is no law at this point.

I can't tell you what will happen in the public sector as far as the problem for regulation. We don't have information on the range and scope of the problem or the type of difficulties we will encounter there. We are looking to see how many buildings contain the material, but I don't have that information today. It is not that we are not concerned.

VOICE: I would concur with this gentleman here in asking for some teeth. We have just gotten voted down twice in one of our schools for removal or encapsulation of asbestos, which has been typified by our state department of health as a serious problem. Basically when we go to town meetings, what is said, well, nobody is going to do anything, so why should we.

That and another comment on scare tactics. There is at least one company in the United States that is sending out brochures to school systems saying that you have got to get it out, the government says you have to get it out, a $25,000 fine initially plus $25,000 a day for every day it is in there, and the school administration is the liable person.

MR. DORSEY: And on Friday I received that brochure, and I think that that brochure will no longer be distributed. Those kinds of documents, that one particularly, I have a number of problems with, and any information along those lines that you see, if you will alert me to the fact, we will contact the companies and the people involved and try to stop that.

The regulatory process is so difficult, the identification notification rule is at EPA now going through for review. It has basically been supported. I is not a new proposal. For the last two and a half years we have been working with the states.

Almost everyone that would be affected by the regulations, the associations, the education groups, the various state reps, local LEA's, have been involved in that rulemaking.

It is possible in the future that we will have an abatement rule, but the first step has to be a standard whereby we can measure the problems out there and provide some guidance. At this point it is really a research program. The algorithm was developed primarily by Sawyer at Yale.

It has been emperically bested over the last year. Chris Williams is with us, who developed a first test in his state. We are providing better training in the use of an algorithm, but it is still a difficult problem.

VOICE: I think you implied that there were conditions where containment of asbestos would not require any action.

MR. DORSEY: Not warrant action at this time.

VOICE: What repercussions would this have to insurance companies that take a contingent liability to this, that they are somewhat hesitant to somebody referring this as a result of that kind of a comment from EPA?

MR. DORSEY: That is a good question. I don't have an answer for you.

VOICE: That could be frought with an awful lot of probems on the part of the client.

MR. DORSEY: Right. We have a risk assessment document which is available to anyone. We are saying a certain number of materials obviously damaged, deteriorating, highly friable, that something should be done about that material. We are not saying that you have to contain all the material there.

But the comments are made that sometime in the future that has to be dealt with. We are not recommending a containment action at this time because the building isin good repair. Insurance purpose, I don't have an answer for you.

VOICE: In case somebody gets a related disease, he is a law suit. Does that statement contain a force of law? He can go into court and all you have to do is mention that the person's debility was as a result of asbestos exposure in that area, the defense will say that the EPA stated that it doesn't necessarily have to be reacted at this particular point.

Since tha has no force of law to an extent, and all you have to do is holler asbestos, it is like in a movie theater hollering fire and everybody vacates the place.

MR. DORSEY: Because people are going to overact, and people are going to cause problems in the future doesn't mean that we should not address the problem of asbestos today.

VOICE: I am not saying that. You are follwoing that routine accurately.

MR. DORSEY: The legal repercussions having been difficult. We are saying that we are primarily concerned if you are going to correct your asbestos that you follow a guideline and you follow the OSHA regulations very strictly because the workers have to be protected. You don't want to contaminate the school or the environment.

As far as the identification notification rule, we want people to know where the material is located in the school and warn their people not to disturb it.

VOICE: Where does EPA's jurisdiction stop, on the outside or on the inside of a school? Is there a grey line there?

MR. DORSEY: There are a few lines, but primarily because we have various acts under which we regulate. Under the Clean Air Act, we can regulate any pollutant that would contaminate the ambient environment, in some cases the indoor air.

It is a general act that has to be applied to a specific problem. Under the Toxic Substances Control Act, the act under which we regulate, we are primarily concerned with the specific problem, no matter where it is located. So if it is a toxic substance and we identify a problem that is manufacturing, distribution in commerce, disposal, et cetera, we can regulate it.

But it could be that we will work in conjunction with another regulation or under another act or maybe it might be multiple regulations under various acts.

Could we take a break for about a half an hour?

(Recess.)

MR. REINHARDT: Before we get started with the next speaker, I have a few announcements.

Mr. Lory will talk until 12:30 and we will reconvene at 2:30. There will be an opportunity this afternoon for you to ask any questions of Mr. Dorsey and Mr. Mirick that you didn't get a chance to this morning. On the table outside, if you want to be put on a mailing list for any EPA publications that have come out or will come out in the future, please sign up out there.

I guess there are now proposed identification and notification rules are out there and you can pick up a copy of that if you like.

Also if you haven't yet signed in, the people who are running the conference would appreciate it if you could. I would like to introduce Mr. Ernest Lory, who works at the United States Navy Civil Engineering Laboratory in California.

He has been doing research with asbestos for about six years and has, I guess, recently completed the program which undertook to inspect all of the Navy's shore facilities for friable asbestos-containing materials, and he is going to talk about his research on asbestos friable insulating material encapsulating agents.

MR. LORY: Good morning. I am glad to be here in Washington again and I would like to bring you through some technical information and other types of information concerning friable insulating material as well as encapsulating agents to bring us all up to about the same speed. I know some of you gentlemen and ladies are well versed in encapsulating agents and others of you are on the architectural side who understand buildings, but I hope to bring everybody up to approximately the same speed.

In the past decade, there has been an increasing awareness of the significance of environmental contamination as a cause of disease, including cancer. The physical characteristics of asbestos fibers and the widespread and varied sources of friable insulation materials (FIM) containing asbestos have caused concern for human exposure to asbestos in both occupational and non-occupational settings within buildings containing such materials.

Hazard potential from asbestos exposure for the population involved in these buildings is believed to be significant. Because of the widespread use and the ease of fiber dissemination, friable asbestos insulation material and pipe insulation can be considered the most significant sources of asbestos fibers in the indoor environment.

Asbestos-insulating material has been applied to ceilings and walls are found in widely differeng building types -- large offices, schools, gymnasiums, swimming pools, industrial facilities, and machine shops.

Recognition of potential health hazards from exposure to asbestos fibers have prompted OSHA, EPA, and other federal agencies to enact regulations for maximum exposure levels to asbestos fibers to protect the public, tradespeople, and environment.

The friable asbestos abatement program -- four years ago the U.S. Navy undertook a program to survey all of its shore facilities in CONUS in the 50 states. This involved about 22,000 buildings. We first tried to define the problem by surveying the buildings, locating the materials and sampling it.

Then we went into an assessment program of the risk evaluation. This is conducted by architects and engineers. Then we go into an evaluation of what type of alternative corrective measures can be taken, and from there the Navy is going to have a program to abate the hazard potentials. Often today you will also see the letters SAI. That was a previous nomenclature which we used in the Navy for Spray-applied Insulation. So you will see that off and on today but it means the same thing as FIM.

SAI is defined as any insulation that can be crumbled, pulverized, or reduced to powder in the hand. FIM can be collected by scraping or boring a plastic sampler into or across the surface of the material.

Ease of sampling constitutes a measure of the friability of the material in question. FIM, potentially containing asbestos, is separated into three general categories: fibrous insulation, granular/cementitious insulation, and insulating/fireproofing concrete. FIM of nearly identical appearance and composition may contain vermiculite, rockwool, or fibrous glass may contain up to 100 percent asbestos or no asbestos. The thickness of most FIM commonly varies from 0.25 cm -- about one-eighth of an inch -- to over 5.0 cm -- about two inches.

TYpical fibrous FIM may contain asbestos -- also called asbestiform -- fibers. Tamped finishes are normally encountered where the FIM is in view. Untamped fibrous FIM is found in areas of limited access -- boiler rooms, penthouses -- and is normally out of view.

Granular/cementitious -- this type of FIM has a coarse sand appearance and has been used for sound absorption as well as for decorative purposes. Granular, cementitious material may be easily removed from the surface by very little mechanical disturbance -- wiping with the hand.

Insulating/fireproofing concrete -- I know that at times there is a distinction that the Navy uses in this third category versus the EPA, which not necessarily uses this third category negotiation, but the insulating/fireproofing concrete, this type of FIM has a foamy appearance with a strong possibility of containing vermiculite or mica. Insulating concrete may be soft and spongy to hand pressure or may require use of a mechanical device to penetrate the material surface.

Insulating concrete is traditionally applied to steel members of high rise structures. This type of FIM is normally hidden from view, but may still cause fiber release to respirable air.

Components of FIM. At the end of World War II, asbestos fibers were in short supply, so manufacturers looked for combinations of other fibrous materials to obtain the same end result.

During this time, mineral wool in combination with asbestos and nonflammable binders was introduced. This is a rock of asbestos fibers showing how they are in appearance.

Products, however, still contained between 20 percent and 30 percent asbestos, usually of the chrysotile group. Up until the restrictions of the law by EPA.

Materials replacing asbestos fibers in spraybel products are mineral wool and vermiculite.

Mineral wool is a generic term which includes fibrous glass, rock wools, and slag wool. Rockwool is made from basalt which is melted and then spun; it has a higher temperature resistance but is more expensive to produce than slag wool.

Slag wool is spun from disposed iron slag after melting. Rock and slag wools have some of the properties of chrysotile asbestos fibers but generally lack the high degree of flexibility and strength of chrysotile fibers. Fibrous glass comes from a process of melting and fiberizing sand.

Vermiculite is an expanded exfoliate of any number of hydrous silicates and comes in short pellet form. Manufacturers depend more on the binder in the FIM material to hold the insulation together and in place than on the vermiculite ingredient. Due to the natural low fiber content of hydrous silicates, a low asbestos fiber content is found in vermiculite mixes.

FIM binding agents were not standardized either; organic -- resins, glue, flour -- and inorganic agents -- sodium silicate, portland cement, bentonite clay -- were mixed in various combinations to obtain the desired adhesive properties.

Bulk Material Analysis. The petrographic microscope, a transmitted polarized light microscope (PLM) instrument with dispersion staining, is widely used for identification and characterization of crystalline substances by their optical and crystallographic properties.

As shown in the slide on the right hand side, the same fiber rotated 90 degrees changes color. This color change is used to identify asbestos fibers. This technique was used by the Navy to identify the bulk material samples that were sent to CEL.

X-ray techniques are used on small samples of suspect material, and a pattern fingerprinting uniquely characteristic of any crystalline materials present is produced. This method was used for quality control checks on PLM analysis.

Bulk material analysis results shown on the following slides indicate wide disruption of fiber concentration, type of asbestos fibers, as well as other bulk material identified in the samples.

In this slide we see crystotile. These percentages represent about 200 different analyses. To read through the slide a little bit, fibrous, where we hae this crystotile fiber alone was in 22 percent of our samples. The mixture is a mixture of crystotile and amosite in two percent. The five percent of the fibrous looking material contain crystotile and fibrous glass and three percent contained crystotile and cellulose.

Granular/cementitious, 22 percent, crystotile as the major fiber material. Amosite and crystotile is found in one percent and two percent of the fibrous glass crystotile and the granular/cementitious.

Insulting, fire proofing, 17 percent was just straight crystotile and in the mixture of fibrous glass and crystotile, it is one percent.

This data does not show what our cellulose only products would be, our mineral wool only products would be. This is just strictly the products in which we found asbestos fibers present in the bulk material. This is the amosite and crocidolite FIM. Again, where it says amosite, fibrous, it is the only amosite present in the bulk material, 11 percent. Three percent is the mixture where amosite was the predominant fiber and the chrysotile was the minor percentage.

And fibrous glass, amosite was in three percent of the fibrous material. Granular/cementitious, three percent amosite. Crocidolite, we found it in one percent. In those samples, the crocidolite was probably somewhere around 90 to 95 percent of the fiber content and the bulk material.

Selection of the appropriate corrective alternative should reach the most efficient long-term solution after material condition,location, function, and cost are considered. Each building area which contains FIM must be considered separately in risk evaluation and abatement. The importance and magnitude of proper assessment of alternatives for deficiency abatement cannot be stressed strongly enough.

In selecting a corrective method, personel should determine if the situation requires entire removal of asbestos materials to eliminate exposure or merely control of exposure by containment methods. Enclosure and encapsulation are containment methods that only prevent exposure to the sprayed material but do not eliminate the contamination source.

The time between the long-term corrective action such as removal, enclosure or encapsulation, interim control measures should be established. An interim control program should include as a minimum the following elements.

One. Educational media system to inform the occupants of the building about the potential health risk.

Two. Flagging system for building maintenance file. This alerts the contract writer and trouble call scheduler so they may properly inform bidder or shop personnel of the asbestos hazard in that building.

Three. Periodic inspection and air monitoring schedule for detecting any changes in the condition of the remaining asbestos FIM.

Four. Maintenance work procedures for various trades. This effort will be to establish methods to protect the worker and occupants of the building and prevent excess release of fibers from the FIM.

Five. Proper custodial dust control procedures should be established.

I know this is not what we are talking about today, but I wanted to go over these two other methods of long-term control.

Removal. Asbestos removal provides a long-term solution by elimination of the contaminant source. Removal, however, requires renovation involving friable asbestos material, with significant problems of worker protection, considerable interruption of building activities, and possible replacement with asbestos-free insulation.

Removal of sprayed material is recommended when any one of the following conditions is present:

One, the material is friable and significantly deteriorated or damaged.

Two, the material is accessible and potentially subject to damage by vandalism or activities in the space.

Three, the material will be damaged during routine maintenance activities.

Enclosure. Enclosure of a sprayed asbestos surface places an impervious barrier between asbestos-containing materials and areas of occupancy. Attached lath systems or a framework with gypsum board are usually employed. Depending upon the integrity and type of barrier systems, dissemination of fibers by fallout will take place behind the barrier only, and exposure outside the barrier will be greatly reduced. Entry into these enclosure areas requires personnel protection and fiber containment pre-cautions.

Enclosure systems can be employed, similar to a wainscoting, to contain FIM on the lower nine feet. All utilities, where possible, should be removed and rerouted from the enclosure space; when feasible, no access should be built to this space. The space behind a barrier system must not connect with the air plenum, and air from the enclosed space must not circulate within the occupied building.

Enclosure of asbestos-containing material can be used, provided that the material is not potentially subject to:

One, frequent damage during routine maintenance activities;

Two, water damage;

Three, condensation buildup.

And the one that we are discussing today and tomorrow is encapsulation, and this is another method of containing the friable asbestos insulating materials.

To control potential asbestos exposure in rooms, encapsulating agents are being applied. Encapsulation of sprayed asbestos surfaces involves applying material that will envelop or coat the fiber matrix, restricting the release of fibers, and afford minimal protection against contact disturbance. Encapsulants consist of polymers with an agent added to enhance penetration into the fiber matrix.

Integrity of an encapsulated surface depends upon bonding between asbestos material and supporting structural members and internal cohesion of FIM. A sprayed asbestos ceiling for example, with initially poor adhesion to a smooth surface will result in shearing -- exfoliation -- and failure of the full thickness of sprayed material and the applied sealant.

Desirable FIM properties. These are various categoris of FIM or SAI damage that you should be aware of when you are considering encapsulation. Number one is water damage. This light brown area is where there has been some roof leaks and leeting water penetrate through the roof and damaging the friable insulating material.

Deterioration, just due to the age or not adhering well to the structural members such as the steel column. The asbestos is exfoliating.

Deterioration and vibration has caused release of FIM from this structure. Accidental damage -- this is caused by maintenance people who were talking on these catwalks and as they were carrying their equipment or tools and things like that, they have rubbed up against this asbestos-containing insulating material.

Vandalism. In remodeling, there is potential significant damage occurring to FIM. In this case, we have two different types of remodeling that have caused FIM to be removed from the steel structure. One is when an electrical conduit was put in place the electrician just scraped away the FIM, and also when they installed a T bar grid for a suspended ceiling, again, the FIM was scraped.

Use of sealants is governed by the characteristics of the FIM surface.

All structural materials used in building construction are adversely affected by elevated temperatures. Mechanical properties, such as tensile and compressive strength, stiffness, and ductility, deteriorate with an increase in temperature. Although steel, whether used in a structural frame or as reinforcement in concrete, is noncombustible, it loses strength when exposed to fire. Because it loses its strength at high temperatures, steel must be protected by a fire-proofing material.

Thermal insulation. FIM, when applied as thermal insulation, retards the flow of hat energy by restricting the conductive, convective, and radiative transfer mechanism of the material. The ability of a material to retard the flow of heat is determined by measuring thermal conductivity or heat conductance.

To be of value, thermal insulation materials must have low thermal conductivity or high thermal resistivity.

Acoustical control. One of the widest uses of FIM in architectural applications is in control of sound.

FIM has excellent properties for architectural applications because of its lack of reverberant surfaces.

Although the characteristics of sound energy absorption depend on the density of sprayable materials, the efficiency generally improves with an incrase in the applied thickness of the FIM material. Since the sprayable product is generally applied to hard surfaces with no airspace behind them, all sound energy must be dissipated within the acoustical control material.

Chemistry and technology of encapsulants. Encapsulant Components. Encapsulatns have three basis component parts: the volatile vehicle -- solvent, the nonvolatile vehicle -- resin -- and the pigment.

The desirable FIM properties that should be considered when selecting encapsulation of FIM, will these properties change due to the agent application? We do not know that yet.

These are some of the areas that are being investigated.

The pigment is the only solid material in the coating. The resin component is dissolved in the solvent so that the finely ground pigment dispersed in the mixed vehicle is the only solid material present in the coating. The solvent evaporates into the atmosphere as the coating cures so that none of it remains in the cured film.

The resin -- sometimes called binder -- is composed of two or more polymers or prepolymers that form a continuous film upon curing of the coating and coatings are classified generically by the type of resins used in their formulations.

The primary pigments used in coatings are opaque and, thus, impart hiding as well as color. Because titanium dioxide has more opacity than other primary pigments, it is used extensively in both white and colored coatings.

Secondary pigments include, one, fillers, such as talc, to regulate flow, brushability, et cetera; two, fibers to impart reinforcement in the encapsulating agent; three, flakes to reduce water permeability or impart abrasion resistance.

Other materials, such as driers, plasticizers, ultra-violet light absorbers, and emulsifiers, are added to coatings to impart special properties. For laboratory purposes, they are considered to be part of the resin or pigment, depending upon their solubility.

While all solvent is lost upon curing of the coating, the proportions of resin and pigment remain the same. The extent of pigmentation -- particularly opaque pigment -- is inversely related to coating gloss. Thus, much more pigment is exposed in low gloss -- flat -- than in high gloss coating surfaces. Except for gloss, color, and texture, almost all the important properties of a coating are determined by the properties of the resin.

As shown in this slide, when there is a high percentage of pigment there is a lot of pigment granules showing here, wherein a low pigment, a high resin content, you hae more binding power of the encapsulating agent.

Encapsulating agent categories -- the generalized properties relating to chemistry here are the ones which we are concerned with, particularly in the encapsulation of FIM are one, the performance and different substrate, two, the compatibility with other coatings, three, flexibility and toughness.

Asbestos control. With the EPA study and Bill Mirick's work, they were investigating various properties of the encapsulating agent, which Bill Mirick has presented this mornng already.

In addition, the ASTM subcommittee is looking at standards to determine friability. This is one of the big questions that has come up. A very muscular person can take even a rock and crush it and say it pulverizes in myhand, where somebody else it would take a tremendous amount of pressure, and so the standardization for friability has not been set, so the ASTM subcommittees are trying to work on that.

The asbestos material classification system is being worked on, the cohesion/adhesion. Fire rating is being looked at. When you apply an encapsulating agent does your fire rating of the material, is it reduced, and then it comes into insurance problems and things like that. This is being addressed currently. And the question about bridging versus penetrating materials is being addressed.

So these are being looked at by various experts in a meeting of the minds on these various subjects.

As Bill Mirick mentioned this morning, encapsulants are divided into two categories, the penetrating type and the bridging type in which the penetrating agent exhibits improved cohesive strength and impact resistance, potentially through a certain depth of the FIM matrix where the bridging forms a membrane over the surface of the FIM.

In various articles and literature manufacturers stated that their product can produce a membrane over the surfaces while others stated that their substance can extend one or two inches into the FIM and bind the product to steel or concrete.

The Civil Engineering Laboratory, in conjunction with the U.S. Postal Service and EPA Regional Offices, has conducted a few field tests of several encapsulating agents on the same asbestos FIM. The following slides are Scanning Electron Microscope -- SEM -- micrographs showing top surface and cross-sectional surfaces of FIM encapsulated with different encapsulating agents.

I am not going to be using any commercial names, so please don't ask for them. In this encapsulating agent, it was classified or it should be classified as a bridging material.

This is a surface of a FIM material which contained probably 40 percent chrysotile. It is a 30 magnification. The holes such as this one here is 100 micrometers in width, which is about equivalent to 4 mils. And as most of you realize, the respirable fiber size or the type that are of concern are proably from about 0.1 micrometers all the way to somewhere around 30 micrometers.

I am not positive on those numbers, so don't quote me. This is a cross section of the same material. The one on the left-hand side is a 30 magnification and the one on the right hand side is a 500 magnification, showing the inner section between the encapsulated material and the non-encapsulated material and this is basically right in this area here.

(Slide.)

MR. LORY: This is another bridging agent, and again we have some holes in this continuous membrane, which is approximately 100 micrometers or 4 mils, and this is on the non-asbestos test material.

(Slide.)

MR. LORY: This is a cross section of the same bridging agent, with a 30 magnification, and again, 500 magnification, showing the area between the encapsulant and the material that is not bound by an encapsulating agent.

This 500 magnification is of this area right here. This is the same product which I just talked about, a bridging agent, being applied to an asbestos FIM, and this is a 15 percent chrysotile asbestos matrix. We have a 30 magnification and a 100 magnification.

One of the things that we are trying to look at in this cursory investigation is do we see fibers in these holes that are not encapsulated or have any binding agent on them.

And it is inconclusive, I will let you know now. But it is something to be aware of.

(Slide.)

MR. LORY: This is a cross section of the same briding agent on the FIM containing asbestos. Again, the briding agent penetrated only a short distance into the matrix, and it is binding the very top layer of asbestos fibers together, but it is not going to any great depth, and this is, of course, why it is called a bridging agent.

(Slide.)

MR. LORY: This is a penetrating agent. Again, we are looking at a surface in which we have a 100 magnification and a 500 magnification. Again, we were trying to look into the fiber matrix to see if we see any fibers that are not coated with the penetrating agent. And again, it was inconclusive.

We have to do additional work in this area.

(Slide.)

MR. LORY: With this same maerial as we just looked at, we looked at again a cross section of it, and we made little sections, as you can see here, and we will be looking at each one of these sections in depth at a greater magnification.

This is a 30 magnification, this is 100 magnification. Again, this is a penetrating agent. Again, the top surface looks fiarly well bound together, but as we start to go deeper into the material, we are finding pockets of areas that are not encapsulated, and we are talking about this area right in here.

(Slide.)

MR. LORY: Again, we are finding pockets un-encapsulated, but every once in a while we find areas in which the penetrating agent was able to come down a strand or something and encapsulate certain areas of the FIM.

So, in other words, we do not have a continuous agent from the surface of the asbestos FIM all the way to the structural member.

(Slide.)

MR. LORY: This is the same agent that we just looked at in cross section -- the other material is a non-asbestos material. I am sorry if I used the word asbestos on that. But this is the same agent that was used on a 15 percent chrysotile mixture.

Again, we have a ten magnification blow-up and we have a 30 magnification. Again, we appear to have fibers that are not being tied very well to the fiber matrix. We can't absolutely identify them, but we are looking at them.

(Slide.)

MR. LORY: This is a cross section of the same material that we have looked at in the last six or seven slides. Again, we have a tremendous number of asbestos fibers that are not coated or enveloped with an encapsulating agent.

We have some good penetration in this area, but we have a lot of material that is not being bound by any agent.

(Slide.)

MR. LORY: This is a different encapsulating agent and it is also a penetrating type, a 30 magnification, and, again, 100 magnification. Again, we have tried to look into these holes and see if we found any fibers that were loose.

Again, nothing conclusive. I am saying this time and time again, but we have looked at other SCM micrographs and we have found fibers that were quite loose in these holes, showing that the agents were not binding the fibers even right on the surface if the holes were big enough.

(Slide.)

MR. LORY: This is the same material that I just mentioned in the last two slides, with a cross section here of ten magnification and over here a 30 magnification. Again, we see the encapsulating agent penetrating to a certain depth, and this is blow-up. We get some strands that are coated.

We find other strands that are not bound by agents -- pardon me -- fibers that are not bound by agents.

(Slide.)

MR. LORY: This is another produce of a penetrating classification. We have a 30 magnification and 100 magnification.

This slide is this area right in front of you.

(Slide.)

MR. LORY: And this is a cross sectional view of that view we just looked at. This is a ten magnification and over here we have a 30 magnification. You see that in the top area right over here.

Again, we are finding some fibers that are not coated very well.

(Slide.)

MR. LORY: This demonstrates this quite well.

(Slide.)

MR. LORY: But at times we find pockets --

VOICE: What is the binder of the material?

MR. LORY: I do not have a binder composition of the asbestos materials. We have tried to identify organic versus inorganic binders of the FIM, but we have not made anything thus far.

VOICE: Do you have any ball park figure as far as percentage?

MR. LORY: On this material here it is 15 percent chrysotile, and I don't have the rest of the makeup of the material.

VOICE: On the left hand slide, what are the white areas?

MR. LORY: You are going to have to appreciate that SEM -- there is quite an art to be able to get a good coating of gold on the asbestos materials, and you will get some bright areas. Jim Hubbard may be able to address that better, but I cannot presently identify this bright area as being all encapsulant.

VOICE: You made the statement that it is obvious that some are coated and some uncoated. To us sitting here it is not obvious, I don't think.

MR. LORY: What we are looking at, over here you can see that some of the fibers are not -- you see this fiber here, you can see a very definite shape to it. But when we have encapsulating agent or a binding agent -- pardon me -- the shape of the fiber changes due to the coating of the materials. And this was one of the areas that we were wanting to do more extensive work on, is to put a tag into the encapsulating agent in which we can identify through x-ray analysis.

In other words, the gallon or five gallons of encapsulating agent, we will add something else to it so it can be readily picked up by other systems as we are looking at it and we can detect where the resin stopped its penetration and where the asbestos fibers are.

As I said, this is just a cursory survey of encapsulating material. I don't want to make any conclusions. I am just presenting them.

VOICE: Were thse taken from jobs actually done or are they samples you prepared?

MR. LORY: No. When I talk about 15 percent chrysotile, this is actually in a structure in which we used five different encapsulating agents, the same asbestos material, using five different encapsulating agents, and these are the series we are going through now.

VOICE: Actual job situations?

MR. LORY: Actual job situations in which the contractor bought five gallon containers of four of the encapsulating agents and enough agents to finish off the building.

VOICE: Were they done as part of a contract or under controlled conditions or how were they done?

MR. LORY: The control is that the contractor applied the material as directed by the manufacturer. The only control we had was that the material was all the same. It was the same contractor doing the same application as a contractor would normally apply, using the specifications in which the sealant manufacturer recommended -- let's see if I forget anything -- but basically we did not try to create a laboratory condition.

The only condition we had was that we used five different encapsulating agents.

VOICE: Was he being observed or monitored? How closely was this whole operation being --

MR. LORY: The contractor -- we did not have a paint inspector present during the application, and the only -- the criterion under which the contract was written was that he apply the encapsulating agent through the specifications or the recommendation of the manufacturer, so we were trying to do it as to what we normally find out in the field. Nothing special except five different agents.

VOICE: What criteria was used in selecting of materials and how was this disseminated down to prospective manufacturers to be entertained in this purpose? Is this the one that was conducted at the post office on the West Coast?

MR. LORY: Yes, it was.

VOICE: How this disseminated out to responsible contractors that could participate in this for the benefit of the federal government and, of course, to the benefit of the manufacturer?

MR. LORY: As I said, this was a cursory field test. We selected five agents and the contractor applied those agents as the manufacturer specified.

VOICE: What was the criteria used in the selection by the government of these five agents?

MR. LORY: We had selected -- we did not have control over all five agents. We had control over the candidates of four of the materials. The fifth one was selected by the contractor.

VOICE: What criteria was used for the candidates?

MR. LORY: The candidates were selected

according to previous applications in known conditions, and we were not trying to run all 200 agents. That is the reason why I don't want to give agent names or whatever else.

This, as I said, is a cursory study, and we were just trying to see what five different agents would do being applied by a contractor to a similar material, FIM material.

VOICE: Localized manufacture units? Were thse scattered throughout the country, these selection of five, by the manufacturer's materials?

MR. LORY: They were scattered. They were not local.

VOICE: Was this advertised that this test was going to be conducted?

MR. LORY: No. It was not advertised.

VOICE: Has any of your accumulated data from the Civil Engineering Lab been used to confirm or to discredit any of the Battelle findings, and if it has not, are you doing to do something with the ASTM?

MR. LORY: We used the Battelle work as our initial point to look at encapsulating agents. We don't wantt to reinvent the wheel. It is impractical to reinvent the wheel.

And so we have taken Battelle's effort as well as other known encapsulating agents that have not submitted to Battelle to be evaluated, and we took those agents -- as I am saying, we have done cursory work in this investigation. We are going in a little bit different way than Battelle's effort in research and our research is not conclusive at this time.

The Navy's work will be continued on for the next year, year and a half, which will include additional effort in looking at encapsulating agents, characterization, the potential field test methods that could be used at Navy activities, a guide specification in selecting an encapsulating agent, and a guide specification on the application of encapsulating agents is the area in which the Navy is being directed at the present time.

I don't know if I answered your question.

VOICE: To some degree. In other words, you are only concerned with the military sector, and that is what the purpose of the --

MR. LORY: Okay. The term military sector is a refined term, but you must realize that the Navy has as many different buildings as conceivable from administrative buildings, schools, gymnasiums, swimming pools and heavy industrial areas and so on, so we cover a wide range of building types or facility types.

So when we are looking at the application of encapsulating agents, we are looking at a potential for all of those different types of structures. We hopefully do not have a problem in which the schools have concerning vandalism and mischievous types of activities that could definitely curtail the selection of certain corrective measures.

And so if we were looking at more of the adult population rather than the adolescent or the K-12. Is that satisfactory?

VOICE: Yes.

MR. LORY: Yes?

VOICE: Mr. Lory, could you tell us how thick the sample is in actuality?

MR. LORY: The FIM sample?

VOICE: The samples that we have been looking at in the slides, how thick are they? An inch, two inches, a quarter inch?

MR. LORY: Of the FIM or the penetration?

VOICE: The FIM itself, the sample you took off after you had it encapsulated or penetrated by the contractor.

MR. LORY: The one that was done on the West Coast, the material was anywhere from a half inch to two inches thick.

VOICE: What is the general depth of binding that you are getting from the penetrating sealants? If you look at the slide over here, how far down is it going down and actually binding the fibers? At what point do you get vacuums or areas where the material is not penetrating to inches, if you can do it that way?

MR. LORY: I am not prepared to give it to you in that way. It is just that some of the agents, which I will show you in just a moment, penetrated the full depth of two inches. Other agents we were barely able to detect it within a quarter inch of the surface.

And so depending on the agent, and again, I feel it is the type of FIM which you are addressing, so what I am -- the bottom line is that each building is unique. Each application of FIM is unique.

There is no standard FIM, asbestos-containing material applied. It was every time the contractor got to a building and was told to apply FIM material, he obtained whatever material he could, off the street or from manufacturers or whatever else, combined the various components and hoped that it met the acoustic properties or the thermal insulation properties or the fire proofing properties that was required by the specifications or the codes of that city or state.

VOICE: The slides that we are looking at, would you classify this material as friable? Would this particular FIM be classified as friable?

MR. LORY: Very definitely.

VOICE: You had indicated already still ongoing tests that are being made by Navy?

MR. LORY: Correct.

VOICE: Will the responsible manufacturers who have a reasonable track record in the field be invited or can they invite themselves in to conduct a test with materials of their own?

MR. LORY: We are not in the position to at the present time take in large numbers of manufacturers' products and evaluate them. We are trying to approach it in a different way than the EPA encapsulating agent studies.

We are trying to go more towards the overall performance of certain generic types of encapsulating agents. In other words, we probably will never come up with a list saying this, this, this and this is acceptable under these conditions.

Our eventual goal is saying that with this generic type of resin and percent solids, pigment solids, being tested, a field test in the building on the specific FIM that is found in the building, you should get this type of characterization of the encapsulant.

VOICE: Was the generic polimeric material then confirmed?

MR. LORY: This is a cursory study. We have not addressed all the questions which you are presenting.

VOICE: The question was whether the generic nature of the polimers had been determined prior to the test.

MR. LORY: They have not. We have got the manufacturers' names and we have got samples of the material, and we can, through our paint lab, we can determine it or we can obtain it.

(Slide.)

MR. LORY: This is one of the binding agents that was not in the Battelle study as far as I know, but we have seen that it looked fairly good in the one application in which we conducted this field study. Again, we have a surface view, planned view, 30 magnification, 100 magnification.

It appears like most of the fibers, even on the surface or in depth have some type of encapsulating agent present.

(Slide.)

MR. LORY: This is a series of slides that will give a cross section of the FIM with the encapsulating agent. This distance is well over an inch and a half. The encapsulating agent -- of course, we do find, you know, the fibers sticking up, but we do in closer observation of the photographs themselves, this is all encapsulating agent.

(Slide.)

MR. LORY: This is the surface right up in this area here. Again, we find some fibers, but there is a coating of encapsulating agent on them.

(Slide.)

MR. LORY: We are going down into the material in this area here. Again, the encapsulating agent did penetrate, and I feel that the contractor did apply all of these encapsulating agents according to the manufacturer's specification and did not favor any of the encapsulating agents.

(Slide.)

MR. LORY: This is continuing down into the depth of the material, and we still see the fibers bound together. We are right in this area right here.

(Slide.)

MR. LORY: This wishbone shaped structure here, again, we still have the encapsulating agent binding the material.

VOICE: When you cut those sections, how did you cut them? Did you do any damage? Those holes in the material, were they gouged out in the cutting or what?

MR. LORY: On this piece of material I do not feel that the preparation caused any of this damage, because this material appeared to have a -- the encapsulating agent all the way through it. It was a condition where you could -- you would have to pull on the material to get it out.

VOICE: Did you use a knife?

MR. LORY: Right. I was not actually present during the preparation of the materials, but it is basically for the cross sections we were using razor blades and sharp instruments like that to try to get a representative cut through, and I think basically we have been pretty luck in that.

This photograph is a continuation on down from this first slide over here.

(Slide.)

MR. LORY: And this is another photograph further on down, but a higher magnification, still showing that the encapsulating agent is present, even below this slide here.

(Slide.)

MR. LORY: One of the areas that was presented by one of the EPA regional office asbestos coordinators is could we use, quote, unquote, a good quality latex paint over the surface of granular/cementitious asbestos containing material.

And so in one of the studies which we worked on, we applied a latex paint that -- Bill Mirick, you are going to have to bring it back to my memory. What was the percentage of resin solids?

MR. MIRICK: Resin solids, 20 percent; 45 percent total solids.

MR. LORY: 45 percent total solids, about 25 percent resin solids. I think between 45 and they were saying sometimes all the way up to 50 or 60 percent total solids. That is what they were classifying at a good latex paint.

I am putting that in quotes.

But here is a surface or planned view, 100 magnification, and this is a cross sectional view of it. This is a granular/cementitious material that contained between 10 and 15 percent chrysotile fibers and a lot of plating material as you see. And this is the latex paint in here.

In this SEM you see some holes. Within the latex paint, the cured latex paint -- this was just applied with an airless spray by going two directions, first one way -- first there was a mis-coat put on. Then they applied the latex paint in one direction and allowed it to cure for one hour, if I am not mistaken, and then went 90 degrees from the original direction.

This is the normal application of it. It was interesting enough that they also took in another test area, did the same application and then they -- what they call backrolled it. You contractors may know what that term means.

It is used in cement, the application of sealants to cement, is where you apply your sealant and then you take a roller and work the sealant into the cement. In this case -- not in this photograph, but in other ones that we have seen, they backrolled the latex paint and these voids were pretty well worked out, and we got a continuous film on it.

(Slide.)

MR. LORY: Current Philosophy. When encapsulation of FIM is appropriate, the following should be considered: field test several candidate encapsulting agents on the material in your facility to select the best material under the conditions in which you are working.

And I want to thank you.

VOICE: Before we close, I would like to make a correction on the record. Earlier this morning I believe Bill Mirick stated that the ASTM number was E-1036. For the record, it is E-736.

MR. REINHARDT: I think we will take a rather long break for lunch now. If we can be back at 2:30 for Mr. Hubbard's talk, which will last about 45 minutes, and then we will have a short discussion period and then you get to hear me some more.

(Whereupon, at 12:22 p.m., the conference was recessed, to reconvene at 2:30 p.m. the same day.)

A F T E R N O O N  S E S S I O N

MR. REINHARDT: At this point I want to introduce James Hubbard, who holds degrees from the Georgia Institute of Technology and works at the Experiment Station at Georgia Tech.

His specialty is electron microscopy and he is going to tell us everything he knows.

MR. HUBBARD: I have brought you some more scanning electron micrographs to look at. You have seen a number of them already this morning and we will try to go through them quickly.

The main topics that I want to bring up are a couple of experiences that I have had in dealing with sealant materials. Two such incidences in particular. One, an ideal situation as much as that can be, the testing wasn't as much as I would like for it to have been but the fact is we were given the opportunity to test a system, a school system who had a problem with the same type of material which you have been looking at this morning, and about 25 percent chrysotile, about 25 percent chrysotile and 75 mineral wool, and they, in my estimation, did the ideal thing of asking a consultant to come in and survey the situation, tell them what the problems were and how they might solve it.

In doing this, this material, by the way, was sprayed onto the steel beams above a drop ceiling, but this area between the drop ceiling and the steel beams was the return air plenum. So that any potentially damaged material or any vibrations in the building could be re-leasing fibers into the air stream of the building.

So I was asked to come in and test the air and help design some tests so that we could see what perhaps sealants might do in this situation. Air sample tests taken before the sealing of the material began and after sealing of the material, this was done with the optical microscope., not with the transmission electron microscope, because we were still infants in the field and this was the OSHA way to do it and we have little by little been learning that really if funds will allow, transmission electromicroscopy in these situations of non-industrial exposures is the only way to go.

Of course, we are dealing with material that is fibrous, but we are working in a school that has some carpeted areas, has a tremendous amount of paper being thrown around, fibers coming off everywhere, the material is 75 percent mineral wool.

In the optical microscope in air testing the material how much of the material that you see is actually chrysotile?

You can't answer that. You can only answer that with microscopy. I don't like to do it. It takes a long time and is a tedious operation to do those studies.

We tested the air in the building before any of the processes started and in both cases we were well below OSHA's standards of even 0.5 fibers per CC.

After the test, we were about five times or six times higher in actual fibrous count, because they had been in there disturbing the material and it still remained in the air, it hadn't been all cleaned up.

Then we divided what I have called a fiber release test, and this is again started from -- this was sort of the starting point, and these types of tests I have been using on various other materials and in various other situations, and they are sort of evolving as a viable test and changing all the time.

So our first thought in trying to decide what is a fiber release test was to decide, okay, we are going to spray this material, let's see first what happens when you brush or disturb this material as far as how many fibers are released into the atmosphere, fibers that the kids might breath, and then what happens after we have sealed this material with a sealant.

Let's treat it the same way. Let's also think that perhaps we might want to do more testing. We might want to consider what happens with just inadvertent brushing, we might want to consider what happens when the maintenance man has to go into the roof, into the ceiling and do work and digs into this stuff.

Let's try and get the whole story. Let's find out what sealants are doing. In this first test we found that we couldn't do too much damage to the material because the sealant really did not penetrate this material very well.

Again, this was the same type of material that you have seen shown earlier today. And in even the least amount of pressure on the material, we could tell that while the surface had a hard finish due to the sealant, the sealant had not penetrated through too much of the thickness and this material didn't -- I would say none of it was over -- certainly not over an inch, and most of the areas that we tested were less than a half an inch thick.

Now, I didn't have any say or anything in the picking of the sealants. Again, the EPA list was consulted and some sealants, about five, taken, maybe sealants and a bridging agent, as materials which would be used to test on different beams in the different rooms.

Maybe one room the ceiling was opened up and there were six steel beams across, and a piece of plastic was put down the center so that three beams on one side could be used for one sealant and three beams on another side could be used for a different sealant and the different sealants were checked in this building.

Before the sealants were applied, we did a fiber release testing, to try to release some of the fibers and this material is so mushy, you can't really brush it or abraid it, so it was a matter of just damaging it with the hand and see how many fibers were released by it by having an air sampler immediately below the area that we were damaging.

Then after the material had been sealed with the sealant, then we went back and decided we would be a little more scientific about it, so we built this very scientific piece of equipment.

(Slide.)

MR. HUBBARD: Now, as you can see, this is a very scientific looking piece of equipment, of course, designed at Georgia Tech. We don't have the GT on it, but it consists of a wooden block on the top. I rounded all the corners so I wouldn't get any digging in, took some screen wire and bonded it to the surface -- I tried to take everything that I could into consideration.

If I am going to be looking at optical microscopy, I want to be looking at nothing by mineral wool and asbestos.

Bonded the surface with epoxy. If have a stainless steel spring here and a coil spring underneath the thing and you see the plastic gage on the side which has been calibrated with my magic marker and my scales to read the pressure that I am putting onto the surface.

And I felt like this would at least give me some other quantified amount of pressure with an area and a weight that I am pushing onto the surface with.

Unfortunately, the surface just wouldn't stand up to even the first mark, and we ended up just barely rubbing this wooden block onto the surface and making our fiber release test.

The results were that more fibers were released from the sealed material than from the unsealed material. And when we reported this and compared this with some other notes, surprise, surprise, many others in this area, I think in a Paris study even had discovered exactly the same thing, more fibers were released from the sealed material than from the unsealed material.

This was not true in every case. There were some of the sealants that we tried that did not show this. At least one of the sealants that we tried did not show this.

The bridging agents were particularly bad about it. And this especially showed up in the electron microscopy studies. They did allow us to do some of those. So I feel what has happened in this case is that this fibrous material, this chrysotile, which, of course, exists in this material in the form of bundles of fibers -- after all, the basic chrysotile fiber is only about three to 400 angstroms in diameter, it is extremely small, and the chrysotile is very easily cleaved into these fine individual fibers given the chance.

Most of the times the material as it exists in this particular type of material is in the form of bundles and these bundles -- the whole material has been mixed with some binder and the bundles have fairly well held together, and fairly well held to the mineral wool. And when one shakes this material and releases some of the fibers, sure you release a lot of the fibers, but most of the material stays together and falls to the floor and it is not released in a small enough fiber to be an airborne fiber.

Then the question, okay, that happens, but that material is now on the floor and the kids are going to be walking around and they are going to grind it up and it is going to become breathable asbestos as it gets stirred back up into the area.

That also may be true, but our study is concerned with what is going to happen right now. While with the sealed material, now you have a hard surface that is holding these bundles, and again, I believe most of the materials where the data after the fiber release data after the cealing showed tremendous more respirable fibers released.

Those materials tend to hold the outside of the bunddles, seal the surface, perhaps, but they don't really wet, penetrate into the bundle and secure the thing. Instead, it is like in one instance you have a bundle of fibers and you knock that bundle off and it falls to the floor. In the second case you have a bundle of fibers held but when you brush it you brush out the small fibers inside. You are holding the outside and are able to release these fibers into the air and they are much more respirable.

I think we are all agreed anyway that any area which is accessible to any -- especially the kids, is really not a candidate for a sealant, because they are going to damage it.

We know that they are. The next step in our assessment of all of the candidates for sealing was to do a scanning electron microscopy and we went back and took sections of each of the areas where different sealants had been applied, prepared them, I suppose, much the way Ernest's group did by sectioning them as carefully as we could with a razor blade and looking at the cross sections trying to see how deep the penetrant went into this fiber mass.

One of the problems here is that again you have a binder mixed in with this originally, and it is a bit difficult to tell in the scanning electron microscope when you see a coated fiber, is that fiber coated with the original binder or is it coated with the sealant.

Some of the things that we tried to look for, for instance, if I am looking in one particular area and I see two fibers that are lying next to each other, if those fibers don't have some material between them and show a wetting between the two fibers, if you can see a nice sharp corner, there is nothing between them holding them.

If you have a sealing agent you should see a curvature there where this material is wetting. The next few slides are just some of those that we took.

(Slide.)

MR. HUBBARD: This is one of the materials -- I believe this is the sealed area. The flatter area is the one I think that you will see that is next to the beam, and as you can see, it doesn't really look like a continuous sealed surface through the cross section.

We then took pictures next to the surface a quarter of the way in, half the way in, three-quarters and on the outside surface. I am not going to show them all.

(Slide.)

MR. HUBBARD: The next picture shows the outside surface of this particular material. And here you can see the real wetting of this material onto the fibers. The fibers are almost completely encased in this material. You see some sticking out, but you see that the material does wet, and I think this is an indication that we might consider in studying these sealants is how well do they wet.

Most of the fibers you see here are the mineral wool fibers. Just because we see the -- well, if it wets these mineral wool fibers, it is certainly going to encase the asbestos, but we don't really know if it wets the asbestos, so it might be more difficult to actually find a chrysotile fiber bundle and see whether or not this material forms a node with a very high contact angle which says, I don't like that surface.

And the different sealants, by the way, when you are talking about absorbing in and wetting, what is the chrysotile mixed with? Are you going to have catonic or ionic type bonding? Is it really going to wet that material?

Maybe it wets this material, but not that. Why do I seem to have less penetration on these tests that we did than those tests that Ernest showed earlier?

Maybe because, you know -- I don't know -- has the stuff been up there longer? It is a little black and dirty on the outside. And being in the air plenum, has it gotten a layer of oil on the outside?

There are so many questions as to whether a sealant is going to work on this particular material, and of course, this is a hidden material and if it could be sealed, it is not where the kids can get to it and damage it or other people can get to it and damage it, but if you have things in the air that are going to scrape it and release fibers you don't want to use it.

(Slide.)

MR. HUBBARD: Here we see at a quarter, like this material in here is binder. This is probably sealant. You will see it seems to wet very nicely.

That is a pretty good angle. In other words, this is sitting up. This is not just coming right out and wetting right out on that fiber. It could be a matter of how much material is there, too.

This seems to be bridged in here and holding together, but this is within the first quarter and the distance is probably 3/8 of an inch.

Half way into the piece --

(Slide.)

MR. HUBBARD: -- I feel like all of this material that we are seeing is the original binder, and I don't really feel like there is any sealant in here. We see some very fine fibers. They seem fairly clean.

There might be just a little touch of stuff down here. You might say some got there, but in all practicality, there is no real sealant there. The next one is three-quarters of the way in and it shows about the same thing.

(Slide.)

MR. HUBBARD: This is again just another sealant. We will go through this one fairly quickly. A cross section of the material.

The surface is really sealed well. Everything seems nicely bound together, but remember, it is from that surface that I am getting a lot of fibers released on fiber release tests, as these things are being held so that when I do rub that surface I am able to tear the fiber bundles of chrysotile into finer and more airborne fibers than before.

(Slide.)

MR. HUBBARD: Probably a total of less material is released, but I have to look at that. One-quarter of the way in, most of this material I think is original binder. If not, it sure doesn't wet very well anyway.

You see maybe here there is a little bit of the sealant in there by the time you get halfway.

(Slide.)

MR. HUBBARD: This particular one had the best fiber release data, that is, less fibers actually released during the fiber release test after the sealant than before. It is a little bit thicker base. The surface is very well sealed.

(Slide.)

MR. HUBBARD: A quarter of the way in you still see a lot of sealant between the fibers, holding the fibers together, actually glueing them together.

(Slide.)

MR. HUBBARD: Halfway in -- again, halfway in, there doesn't seem to be any of the sealant -- this particular sealant in with the material, and all of the materials seem that was just from the touch.

That is, they weren't hard crusty pieces after being sealed. You could tell they had an outside crust, but the inside was still soft and mushy like the material.

(Slide.)

MR. HUBBARD: This is just another example, again, sealed material here.

(Slide.)

MR. HUBBARD: Outside surface, sealed very well. Again, this particular material perhaps doesn't wet as well. You can see where this material is not really bonding to this fiber. You have got a film here that is covering the surface, but you can see here, you can see here and here and even here it doesn't run up on the fiber, so this particular material doesn't seem to be really wetting the surface.

It is forming a film, but not really wetting it.

(Slide.)

MR. HUBBARD: Within the first quarter of the thickness, which may have been about a quarter of an inch or 3/8's of an inch, there is no sign of any of the sealant there. I believe all this material is the original binder material.

(Slide.)

MR. HUBBARD: The next slide shows the bridging agent. As you can see, we have a very thick film. It has a lot of bubbles in it but it is a continuous film there on the surface. Again, about a quarter of an inch thick there on that piece.

The next slide is taken from this area here.

(Slide.)

MR. HUBBARD: It looks like one continuous surface with no fibers evident. The material has really held tight as I have cut through and cut the fibers off and you can hardly even identify the fibers.

(Slide.)

MR. HUBBARD: And, of course, as soon as we get back behind that bridged surface, then there is, of course, no evidence that we can see of any material being there. Again, this binding agent makes it difficult to analyze that, and like Ernie said, if we can perhaps -- if we were going to do a lot more research, then we could put some trace element -- in other words, I can take a scanning microscope and look at any one spot with my energy dispersive x-ray analyzer and tell the elements that are in any one little spot anywhere along in this material, so that if the bridging agents or sealing agents or whatever I had, I had enough of a trace element, I could go along looking for where it was.

But in my estimation, if you can't really see it there doing the job, then it is not enough to really be concerned about.

(Slide.)

MR. HUBBARD: And that is just on further into that sample.

(Slide.)

MR. HUBBARD: Now, the next job that we had to do concerned a 15 percent chrysotile -- I don't say the next job, but the next one I am going to report to you, anyway.

This is one of the semi-cementitious materials, say, 15 percent chrysotile in perlite. And here is probably the situation that occurs more normally than the first situation where the people in charge of the school system really want to test and see what is happening.

Here the school system discovers that they have got chrysotile. They have got asbestos. It is sprayed onto concrete in the halls, in the ceiling. And they want to do something about it quick.

And they really don't want to let out that they have got this material, and by the way, even in the first situation, all of thse tests, of course, were done when school was out and no mothers or anybody else was around, deep in the dark of night, you know.

And you all know exactly what I am talking about, I am sure. But that is the situation. It is interesting that we have had two sessions at Georgia Tech, two three-day seminars on asbestos, and in most of the situations, of course, most of the people are the same way.

The building managers and owners, they don't want to create a scare, and we don't want to create a scare either, but it was interesting that one of the architects or people who -- I believe he was a school person -- who did have the PTA jump on him about having the material in the school, when he really -- when everybody really came face to face and really opened up talking about the problems and the problems of not knowing exactly what to do and all this, everything was worked out so beautifully instead of everybody running around hiding everything, that most people I feel like when really shown all the facts, everybody is fairly reasonable about everything.

But anyway, in this situation the school officials said, hey, let's do something, let's seal it up. And so the maintenance people picked out a sealant, ran and bought it and sprayed the ceiling.

Unfortunately for the school, the student body president in some newspapers in that area said, hey, is that really the right thing to do. So, again, we were asked to come in and let's just see what the situation is.

Okay. We admit we did wrong. Let's do it right. Please tell us what to do. So we went down and sampled. We did ambient air sampling.

We found very low counts just in the regular daily run of the use of the particular area, but when we did some fiber release tests, and why was fiber release testing necessary?

After all, the stuff was up there on the ceiling. Fiber release testing then went from scraping with my magic tube to simulating exactly what was happening to the material

As I mentioned to somebody at lunch the other day, I said, well, you know, the kids had gotten up there and they had written names in the stuff and they had drawn pictures, and he said, oh, yes, those little tikes just won't leave it alone.

I said, this is a college and the pictures were large pictures. And they are pretty good. So we went in and did some fiber release testing. We were doing some air sampling, and of course, we picked a boys dorm and a girls dorm, and the boys dorm, they didn't like it too much, the pump out there running in the hall for six and a half hours.

The girls didn't seem to mind too much. When I came back, I saw them standing in front of it standing -- they wanted me to find a lot. They were powdering it. The whole day was shot as far as that test was concerned.

As the maintenance said, if we are going to have trouble , it is going to be here in the girls dormitory. Times are really changing. Maybe I don't know what went on in the girls dormitories before.

We didn't have girls at Georgia Tech when I went there, so my education has been neglected. We came in and did fiber release testing on some of the material that had been coated and some that hadn't been coated. This fiber release test took on a little different aspect.

I decided that really we did need to know exactly, say, everything that is going on, so we just used a piece of metal to scrape like the kids would and remove, say, one square inch of the material and find out what happened. We did this inside of more or less a closed container with two holes in it, a hole on one side for the air sampler to check how much material was released into the air that could be breathed, another hole on the other side to let the air pass through and to allow me to go in and scrape the material loose and then the container to catch the material that was released.

We wanted to know how much fiber gets into the air and how much falls to the ground, so these tests were done. Even though we totally removed all of the material and actually the unsealed material was slightly thicker than the material that had been sealed, we still got more fibers released in the air from the sealed material than from the unsealed material.

Now, the real scare here is in that one time, from our ambient air samples we know that the exposure that the kids walking down the hall get is not high. It is fairly low exposure, but there are some kids who are getting their noses right in the stuff and scraping it loose and breathing it.

It is unfortunate kids are that way, but they are, and so are some adults, who are kids, I guess.

But what are the effects of a one time high exposure to a material which from all that we have learned gets into the breathing passages into the lungs and it never leaves?

It is always going to be there. You are certainly not going to get asbestosis. That is high exposure for a long time.

But the cancer risks, and I don't care what all the other people say, I have read the reports, I have had questions, I don't accept things without reading over the techniques that were used to determine whether risks were real or not, and I have accepted these things, one I was reading the other day from Dr. Sillocauf, which states that one fiber could cause a cancer.

You chances of it growing big enough, I suppose, or maybe is increased with the number of fibers in your lungs, and it takes 20, 30, 40 years for this kind of thing to develop.

So in my opinion, we have to get rid of this material, we have to do something with it, and obviously in this case, again, sealing is not the answer because the kids are going to get to it and damage it, unless it can be completely cemented in by this stuff.

Well, again, what we did after the fiber release test was take a sample of the sealed material and take it back and look at it with the electron microscope. Let me try to explain a little bit what this is.

Now, this perlite material, and I know you have all seen this material, a very rough looking material on the surface, you know, and it is sprayed up there right on the concrete, and this is the outside surface and this is a cross section here.

And you can see the asbestos fibers and the thing about this is that all of the fibers you see are going to be chrysotile. So you can see them out here. This is the outside surface.

It, of course, is going in and out and in and out and that is why we can see it here, but this line right here represents the outside surface. Is there anybody that don't see what I am talking about?

This is the outside surface, because this material is a little bit thicker there than whre I have cut. The cut goes through the material right here and this represents the cross section at this point.

Some of the perlitic material has been pulled out. Right here where you see the marker, and this thickness is no more than an eighth of an inch, and so this distance from this surface, we see this particular feature here, which in the next slide --

(Slide.)

MR. HUBBARD: -- we see is obviously asbestos fibers, we can see here, here, all around. We look closer at that --

(Slide.)

MR. HUBBARD: -- and we see no sign of any sealant or material, and an even closer view of that square there, you don't see any kind of bridging in there.

(Slide.)

MR. HUBBARD: Also, putting the electron beam spot right on that fiber, we get the characteristic x-ray elemental analysis of chrysotile, which says to me that that is a bare fiber, with no more than three or four microns thick of material on top of it, if anything there at all.

In other words, I don't really have the figures to know exactly what the penetration of the beam would be, but if I had five or six microns of material coating that fiber, I wouldn't be able to get the x-ray elemental output of the fiber because the beam would be absorbed by that other material.

And from the look of it, you know. There is a nice sharp edge here. To me that is to be expected in that particular type of material. I don't know -- I am not a surface chemist. I don't know about the real wetting of this cementitious material by these sealants.

It would really depend on how thin they are as to how well they could penetrate into a material like that.

Well, we have got a number of problems, and what usually comes out of these seminars we hae at Tech is that everybody goes away realizing that we have more problems than we have answers. And maybe a little more mixed up than when they first came.

You know, sometimes ignorance is bliss and we learn a little bit and then we really get mixed up and really don't know what to do. We have gone from using sealants to not even thinking about them to using them again, and maybe perhaps -- it was kind of, I thought earlier, like the story that one of the medical people told at the last conference, which was about one of the fertility drugs.

I don't remember the name of it. Thalidamide. Where so much research was done on this particular drug before it was every used using rats and mice, guinea pigs and things like that, and they found absolutely no ill effects at all, and so it was put on the market.

As soon as it was put on the market, the birth defects just went right along the graph of it being on the market and being taken off of the market. No, it didn't affect rats, but it affected monkeys and the higher you got into the world of man, the effect increased.

So it is like you hate to wait until all of the data is in from all of the research before you start saying, hey, use this or use that. There are a number of unfortunate things that have happened, of course. The EPA's list, while it is not -- you know, it has the disclaimer and it says we have tested these and these seem to work all right, they have the right fire retardants or they don't smoke and this, that and the other, people look at it and they take it for, hey, the EPA approves this sealant and so therefore we can use it.

That is not the case. We know that is not the case, but the general person who is managing a building doesn't think about that. He is looking for something desparately that he can use.

And that is a problem, and it is part of our job to educate people. There are many sealants that are probably very good that just never got tested. I am always getting calls, hey, I have really got a good product, and I would like for people to try it.

I was really glad to hear Larry say earlier that he was going to encourage people, especially, say they haven't been tried to find someone who will let them come in and run a test and show how their material works, to use the same test that Bill Mirick at Battelle used.

Maybe others. Maybe this fiber release type of thing. The fiber release, I have been put down a little bit on that saying what is fiber release testing, when really if the material is in a position where kids are going to get to it or where it is going to get damaged, then you shouldn't use a sealant anyway, so why use a fiber release test.

We wanted to see what maintenance might do to the stuff, but if the material is not going to be totally sealed and encapsulated all the way to the substrate, and the more I hear about it, the more I don't believe that that is possible, then sealants perhaps should only be considered if they are completely out of the way and maybe we want to look at fiber release tests from air streams that flow by them, but I really believe if they are in the air plenum, maybe we need to be not only sealed, but hidden some other way as well.

Certainly I recommend that some other surface that is after sealing and even after the bridging agents, then some thicker surface film which completely hides the fibers from the immediate surface should be used.

This could avoid any inadvertent brushing against, at least. That is really about what we have done and my thoughts on it. I will welcome any questions that you might have or anyway that we can help you.

VOICE: On your air sampling, what kind of instrumentation did you use, how long were your samples run, what was the air flow through the samplers?

MR. HUBBARD: On the ambient air samples, we tried to go with six and a half hours -- I believe we were using about five liters per minute for six and a half hours. Of course, the longer time you can run and the more air you can pull through the better sampling you will have so the better data you will have.

On the fiber release testing, where I was releasing the fibers in a container, in a very small area, I ran those only about 20 minutes but at 10 liters per minute, which I felt allowed me time to collect all of the fibres that were released into the air.

So instead of coming out with an answer in nanograms per cubic meter, we came out with an answer in nanograms, this many nanograms.

How long does it take for this many nanograms to fill up the space of one meter or something, this is the total nanograms, this gentleman painting a pretty picture in the ceiling could breathe.

VOICE: What were your levels?

MR. HUBBARD: Some of the levels on some of the sealed material were as high as 3,000 nanograms. And that is a lot.

Isn't that right? 3,000 nanograms?

VOICE: What about the unsealed material?

MR. HUBBARD: I believe it was about 400 nanograms. This, by the way, was a penetrating sealant. Yes. On the unsealed material we got released into the air about 400 nanograms. That calculated out, of course, which is kind of -- I don't know-- the number of fibrils per cubic cenitmeter, if you will, that is not fibers, now, but if you calculate -- I give all sort of answers.

That really mixes everybody up, see. So nobody knows what I am talking about. You have fibers per CC which is the fiber bundles, but if you take that bundle and say each individual fibril, how many fibrils are in that fiber?

Again, that could be something like almost 4,000 fibrils per cubic centimeter released in the sealed material, and some 450 in the unsealed material.

VOICE: That is calculated?

MR. HUBBARD: Yes.

VOICE: Is that calculated off your nanograms?

MR. HUBBARD: No. Off number of fibers. What I am counting in the transmission electron microscope is every time I find a fiber, I put down that fiber's length, that fiber's diameter, and of course, I have counted the fiber.

So when I finish I have total number of fibers, plus I put into my calculator the length and diameter and come up with the weight.

VOICE: Based on this conclusion, obviously the encapsulation wasn't to anybody's satisfaction. It was a complete failure?

MR. HUBBARD: Absolutely.

VOICE: One is also basing a premise that this deduction shold carry through for all situations.

MR. HUBBARD: Absolutely.

VOICE: If I may make an assumption, there seems to be more of a tendency for everybody to concern themselves with a complete penetration through the system and unto the substrate and maintain a high interface adhesion as well as a cohesion.

Is this desirable or necessary assuming that the surface characteristics were monolithically adequate in terms of fiber release under normal, evan vandalistic type situations?

Is this penetrant a requisite, assuming that the sheer factor is adequate?

We had found in some conclusions, and we used a rotamean B dye that becomes part of the polymeric materials rather than in the vehicles as such, and the conclusions were under ultraviolate light that we have penetrated within a quarter of an inch and still maintained a high, viable system of non-fiber release, even under excessive abrasive type situations, which would preclude that there is an answer to the problem, without the thought of complete penetrability, and as you know, the asbestos filter is a darn good one, and we have angstrom sizes to the material of around 700, which is a pretty low polymetric size.

We also initiated into the acqueous aspect using floro-chemicals to redynes the dying factor of penetration, wetability of the acqueous phase down to 18 and 16 dynes which almost functioning as an organic solvent.

We injected the material as high as 3300 psi to affect all the mechanical aspects of penetration and still did not get penetration in excess of one-half inch under certain situations.

So I can't see there is a chemical and physical impossibility under all situations to maintain maximum or very deep penetration, but is that desirable assuming that the surface characteristics have been affected?

MR. HUBBARD: I agree with you. I don't think we yet know.

If the material seals -- if it stops release of the material into the air, of course, it still leaves the problem of maintenance, which is always going to be there as long as the material is there, I don't care what form.

VOICE: I understand.

MR. HUBBARD: What is going to happen to your material in two or three years, five years, what if your material is in an area where there is a lot of ozone created, I don't know.

There are too many unknowns.

VOICE: We had exposures outside under UV, and I would presume ozone is present exterior in excess of 18 years with the system maintaining non-destructability. So the presumption from that standpoint that you have an indefinite life period.

It is chemical inertness. None of the reduction type elements will attack the material.

VOICE: We can't hear a thing he said. If some guy is going to make a statement, let him have the mike.

VOICE: I apologize. I don't think I can repeat what I just said.

MR. HUBBARD: We are talking here about the necessity of actually having penetration totally to the base material by a sealant, which some have said is necessary and maybe I have indicated -- I didn't really mean to indicate that -- I did indicate, of course, that that was not happening. I think the fiber release test tells more as far as whether or not it is keeping the fibers away from the atmosphere. But I, again, don't have all of those answers either, but I think a combination of Mirick's work and whether or not the material is going to stay there after the surface is sealed, all of these things have to be taken into account when you decide whether or not you are going to use such a thing.

VOICE: Do you have a ball park figure for nanograms?

MR. HUBBARD: I don't like to -- what are you going to equivocate that to?

When you are talking about fibers per CC, everybody has been talking about optical studies run on the OSHA standards, and that means that you are looking at fibers that are larger than five microns and fibers that hopefully are all asbestos, because these standards were set up for industrial applications where you are looking at somebody sawing some asbestos material or something and you are trying to see how many fibers are there.

Whereas, for every one 5 micron fiber, how many fibers below 5 microns, which is what you are looking at with a transmission microscope, everything from 2/10's of a micron on, how many of those are there, and it is really difficult to find any basis, because in the industrial setting, the size distribution of the fibers is going to be considerably different from what you find 15 miles downwind from a mine where only the finest fibers have stayed aloft and are now counted and maybe the only thing that you see, and probably with optical microscopy you may have nothing and you still may have 150 nanograms per cubic meter in the area.

So it is very difficult. I can tell you how many fibers it meant to me, in the electron microscope, how many actually fibers, but don't try to make an equivalent statement of that is what you would find with optical microscopy.

But in the 3,000 nanograms in this particular case, in using electron microscopy, it turned out to be about 1.4 -- here is a good example.

The 3,000 nanograms in the case of the sealed material, if we just said, all right, how many number of fibers did you find per cubic centimeter of air tested it was 1.4.

The 440 nanograms in the unsealed material came out to be 2.4 fibers per CC. More fibers per CC, but they were small, you see.

So it is really hard to talk about those things together, because you can have big bundles and you can have little bundles. So we give you another double standard that you can't understand.

See, we just always throw these things out at you and try to really keep you mixed up.

VOICE: The encapsulants in your study, were they produced primarily for correcting asbestos or were they products on the market that somebody submitted and said this will take care of that problem?

MR. MARTIN: If I understood your question, you asked if the sealant was studied by Battelle.

MR. HUBBARD: What was the sealant made just for asbestos encapsulation or was it something already on the market that somebody said I think this will do?

MR. MARTIN: The sealant was a sealing that had high range in the Battelle study.

MR. HUBBARD: Have your companies -- are these things that have been on the shelf and you have said, hey, this ought to make a good sealant, or are both things true, are companies looking and saying, hey, what really wets asbestos?

MR. MARTIN: The thing to keep in mind on this is that we were not there to observe the application procedures. We don't know how it was diluted or how it was applied. It was an after-the-fact study.

We used a Battelle sealant and it was one of the ones they had high ratings on. They could have not followed the manufacturer's specifications.

VOICE: It seems like there is such confusion about sealants, asbestos, encapsulants, what have you. It seems like maybe almost like an orphan drug setup. There is already something there and we are giving a shot at it.

Are you working chemically to try to change the asbestos fiber itself?

MR. HUBBARD: One of the problems with asbestos is it is one of the most chemically inert minerals around. That is why it is such a beautiful fiber to use because it is so resistant.

Chrysotile is the least resistant. Crocidolite and amosite which are high on the scale are chemically resistant.

Chrysotile will decompose in water in a couple of years and in the body also. But there is a question as to whether it has already done its damage.

Some of the asbestos bodies that they have found in tissues that look like those where they have identified chrysotile as being the center of this body don't have any centers and so the question is was it a chrysotile fiber that has since dissolved into the body.

That is why amosite, one used so much in the ship building industry, has been such a real baddy to these guys who come down with a lot of cases of cancer, because it is one of the most chemical resistance.

Crocidolite, I think, is one of the most chemically resistant of all the fibers.

VOICE: I have had a few of the ones submitted that were actually formulated for this purpose. There were several companies that sent in chemists and talked things over for a couple of hours and went back absent in the products.

They said they were formulated for this purpose. They are not broken down that way in the report, but we do not have the type of facilities to do that.

Some of them were formulated for that specific purose.

VOICE: Did you verify that these products that you mentioned, the two studies you did, were actually of products and were applied -- you mentioned that it was a Battelle, if you will, listed product?

MR. HUBBARD: They were listed products, but I was asked to do studies on the material after it was sealed. I have no knowledge as to how it was applied, whether it was applied properly or anything like that.

VOICE: Might I ask, then, if you did studies on material as applied, did you run any control with a like product?

MR. HUBBARD: With a like product?

VOICE: With the same product, did you run any control or just examine exactly what you looked at?

MR. HUBBARD: We just examined that that was placed on those beams, yes.

VOICE: No control?

MR. HUBBARD: No. What would I have used as a control?

VOICE: The same material applied according to spec.

MR. HUBBARD: Well, I had to assume it was applied according to spec.

VOICE: That is a qualitative judgment on the same material. It is not your job to do that.

VOICE: Did you try to ascertain the mil thickness on the outside, the surface bridging materials, did you see if they had the mil thickness on the surface? You were looking for penetration, but how about the surface mil?

Were you getting anything close to what the manufacturer specified?

MR. HUBBARD: I don't know. I don't know what the manufacturer specified as far as mil thickness is concerned. Of course, we know how deep into the material you got the solid -- you saw the pictures that showed the outside. That was not a picture of the outside surface. That was a picture of the cross section as we went into the material and you had a more or less continuous film for a certain mil thickness into the material.

VOICE: I am talking about actually the mil thickness of just the bridging material itself.

MR. HUBBARD: Explain to me mil thickness.

VOICE: When you are coating on any kind of material, you are talking about mil thicknesses, the thickness of the actual coating on whatever substrate you are applying it to.

Now you are talking to me about penetration into the asbestos material, so you are going to have a mixture of binders and whatever with the asbestos material, but then you should have a thickness of the bridging material of just the bridging material itself.

MR. HUBBARD: But from the work that I did in looking at the material, when I say that we put virtually no pressure on the material, just rubbing the block across it, we did not just -- we simply scraped that for five or ten secons and found all of these fibers released from it, I assume that the mil thickness is nil.

VOICE: I wonder if it is a surface bridge. We have a surface bridge that I have applied to some materials and tried to cut through it and had trouble cutting through it.

MR. HUBBARD: I didn't -- I am trying to remember right now how much trouble I had cutting that section. Of course, I used a real sharp razor blade. But it appeared to me, and I am sorry, I do not have a scientific real answer for you, that the material did something into the surface, that there were fibers very close to the surface. I am sorry, no, I do not have that mil thickness for you.

VOICE: Based on what he just said, that would indicate a very poor application technique. That first coat, your penetrating sealant, should penetrate, bind up, but that is not your protective layer.

The second application, let's say in the case maybe perhaps applied full strength, would be your laminating layer. This is going to give you the protection, not the same day of application, because then you are going to have a continuous phase, but the second day, and that would give you a thickness that would prevent abrasion.

You wouldn't abrade it with five or ten strokes.

MR. HUBBARD: The point that you are bringing out here is one of the big points. Who is going to apply this stuff?

Do you do this? Are you toing to come down and train the people who are going to apply this material? When we finally say this kind of sealant is going to work, I say fine, it is going to work on this material if you use this guy to spray it on. That is the problem. I am sure that the people who were spraying this mateial on had probably never sprayed on a sealant before, because it was just -- you know, the Battelle study was just out.

Nobody knew how to spray this material on. Nobody still probably knows how to spray this on except the people who developed it and know what they are doing.

I think that is a very big problem that we are going to have in telling people to use them things, because we need to tell them, fine, use them, but listen -- I have contractors who have been to my course at Georgia Tech twice, and I don't care how much we tell them, this stuff is dangerous.

When you go in there to work, you have to be protected. And the very next thing they do is go out the next day and hose down a room without any protection and then put on the protection, because now they are removing the material, remove it and let it fall to the floor, remove their protection, because it is removed, and sweep it up into a bag. Maybe they are really dumb.

Maybe that is it. Or maybe they want to get a quick job for a lot of money done fast. But that is the kind of people you are going to be working with. I don't know what kind of regulations you need to combat that, but I agree, there is a way to apply this stuff, and if not applied right, what good is it?

VOICE: The thing that started this last study was that the students in the college contacted the EPA because of the toxic fumes being generated from the sealant because they were applying them in the dorm while the students were still there.

That is an indication of the level of education people have about this problem. When we say they used a sealant that was studied by Battelle, it does not necessarily follow that they applied it properly.

MR. HUBBARD: That is right.

VOICE: Was that confirmed that it was toxic?

MR. HUBBARD: When these things come out, you look bad.

MR. MARTIN: They were complaining as to the side effects. It was bothering them. I shouldn't say toxic. Wrong choice of words.

MR. HUBBARD: It was just a smell. And all the manufacturers can get to looking bad because of that problem.

VOICE: Well, I have an easy question.

Did the contractors get paid?

MR. MARTIN: They used their own maintenance people.

VOICE: We are contractors, and I would like to know what kind of quality assurance. When we do a job we take one of these manufacturer's products and spray it on and we send around for general superintendent and they don't generally carry a microscope of that nature to take and do the x-rays and all that kind of stuff, so really, what can we do to make sure that we are doing a good job?

Contrary to popular belief, not all contractors are trying to do a less than professional job.

MR. HUBBARD: I have run into some guys that are really great.

VOICE: I have talked to a number of encapsulant manufacturers that they have big distribution systems. Their technical people, they do all these fancy tests and reporting and they get all their things and they send it to distributors.

You have your local paint store getting a painting contractor in the business and saying this is a miracle cure-all for asbestos. We run into an aircraft and he says this is great, it has passed all the rules, it even passed OSHA.

We know that is not true. It is a local small distributor, so they need to inform their people as well.

MR. HUBBARD: It is a big job for education. We are lucky that at least this system we worked with was farsighted enough to say, maybe we can encapsulate this stuff, let's do these test panels and have it tested. Let's pay the five or $10,000 just for the test to see if we can do it.

That is a lot to ask of somebody. It really is.

And most of them aren't going to do it.

VOICE: But that is not even conclusive.

MR. HUBBARD: No, sir, but it is better than --

VOICE: Too many variables.

MR. HUBBARD: Yes, but at least you are working on the material. Although, as I have heard here today, that is fine for this room, what about that room. How much testing can you do, and yet if you don't do enough, what are the kids going to be left with in the future? There has to be some breaking point.

I don't know where it is.

VOICE: The reason I asked you if they had run a control, when the gentleman over here put it better than I did, it does sound like a question of application. The simplest method we have today is to measure off anything that we are involved in.

We have also hired a consulting engineer to inspect our jobs if the parties that are having the work done so request it. We also do measurements as best we can. This is quite independent of Battelle.

I think it is a question of quality control. And there is as much quality control there as anyone wants to put it. We have distributors and our distributors measure off jobs and they will not issue a certificate of compliance if the material is insuffficent for the amount of area to be covered, as best they can judge.

VOICE: I didn't get the last of that. I am sorry.

VOICE: It is a question of quality control, nothing more.

MR. HUBBARD: Yes.

VOICE: No matter what type of material you use, in spite of the fact it might be asbestos, all types of coating materials if not properly applied do not work.

MR. HUBBARD: Right. I absolutely agree. I don't have the answer of how to educate the people that are going to use it other than to say that I have noticed that many companies, for instance, won't even sell their material.

They only apply it. But every company can't do that. We already have the established man power to do that, and yet they may have an extremely good product.

VOICE: The problem with the two samples we did were to investigate a very poor application.

VOICE: Quality control can be initiated, but how can you set up a standard for qualitative judgment of the person that is controlling the qualitative controls? Who will make up the standards for the qualitative judgment on the industry?

Education, skill, what could you pick? That question is rhetorical.

MR. HUBBARD: Thank you very much.

MR. REINHARDT: I would like to announce that I would like all the panelists to meet with me briefly after this day's session is over. I think that the discussions we have been having in the last 20 minues or so are probably more interesting than anything I could think of to say, so what I would like to do at this point is hae Mr. Mirick, Mr. Lory, Mr. Hubbard and Mr. Dorsey come up here and respond to more questions from the audience if you have any and then I will delivery my little presentation tomorrow morning.

If you have questions, could you stand up so that people in the back of the room can hear you and identify yourself and state your affiliation?

MR. DORSEY: Are there any additional questions for Bill or anyone that has spoken today?

VOICE: I would like to make -- there have been two references made -- Ed Drasga with Kerseden Corporation.

There have been two references made here to a specific two treatment aspect, and there was no depth of discussion in this area to optimize the best of the properties that we are attempting to reach, and that is the control of emissions and air safety standards as a result of encapsulation.

The tests from Battelle appear to be singularly treated towards the penetrants and towards the bridging materials. Why not, as there has been investigations and concludions in the field that the correct procedures appears to be, at least the efficacy of the system has been confirmed, under proper application, qualitative judgments, controls in a two component system or a two treatment system as opposed to a single treatment system, and why not some emphasis on that aspect?

I think the gentleman from this company here indicated that that application was necessary in terms to effect the best results of what we hope to achieve, and that is to at least control or elimination of the problem.

Has Battelle made any test in conclusion of the application of both a penetrant and a bridging coating too?

MR. MIRICK: We haven't looked at a combination of systems, per se. Although, again, I think you can -- some of the penetrating sealants and even with some of the bridging sealants, our method of application was to put the first coat in and then a heavier coat, four hours later put another coat on and let that dry overnight and put another coat on in certain areas.

Where you let the penetrating sealant or even the bridging sealant cure overnight and then put another coat on you do have the second barrier effect if you want to call it that.

Once a material is secured, whether the penetrating is cured, there will be no further penetration so the next coat you put on just lays on the surface and essentially gives you a bridging coating on the surface.

VOICE: If the material is 14 percent solid and you use it as a penetrating seal, essentially a blocking agent, you come back the following day and put the same material on, there is not the quantitative requirement to build you the necessary element of bridging aspect to it and is the interface adhesion going to be a viable one?

MR. MIRICK: This is true in the lower solid penetrations. When the penetrations get up to 30, 35 percent, you can get a pretty good bridging surface over the top. Again, we were not evaluating a combination of systems. A penetrating and a bridging sealant probably would do a very good job.

I have no real idea on that. But when you start doing that, again, you are getting into cost factors where removal is probably as economical as a double bridging type system. And if you do that, my opinion would be if it is the same cost, I would in all cases say remove.

VOICE: But I haven't found any system in terms of removability and maintaining all of the standards that would equate the cost of an encapsulation, even in a two component or two treatment system.

MR. MIRICK: Well, I don't have a real good figure on all the costs out there. I have heard mention of systems. Now, I can mention systems that I have not looked at. I feel they would have a good possibility. I know one company goes in and puts a penetrating material on to wet the surface. After that has dried somewhat, they go in with an eighth inch to quarter inch wire mesh, and core it to the concrete with steel anchors and then go over it with a bridging sealant.

They are doing that today.

VOICE: I would think that would equate removability and I would exercise removability on that basis from a cost standpoint.

MR. MIRICK: That is what they are doing and they are selling their product and getting contracts.

VOICE: Robin Thoreau. How long will the encapsulation system last? I have heard some say if you expect it to last more than six years, forget it.

I have heard contractors and seen photographs where they have encapsulated, turned to walk away and see a whole ceiling peel down the corridor. The weight of it just pulled it down.

MR. MIRICK: This has happened and this is some of the horror stories in encapsulation which turned out to be nothing but expensive removal jobs. The material sholdn't have been encapsulated in the first place if it is going to come off before you can walk away.

There are products on the market that have been applied and now have I think 12 or 13 years life on them. There are some coatings that probably -- I don't know -- how long does an organic coating last? That is a good question.

MR. HUBBARD: It depends on the atmosphere, where it is going to be.

VOICE: What are the problems in removing sealed coatings at a later date?

Grossman, Public Works, Canada.

MR. MIRICK: Basically, once you have put an encapsulant on a sealed surface where you are sealing that surface it makes it much more difficult to penetrate with amended water or any product to give you a wet removal. If you have done a real good encapsulation job and you have a good eighth inch barrier of a bridging sealant over the surface, unless you penetrate that, you will not get your wetting agent inside to be able to remove it.

VOICE: May I add something to that? Why is wetability so important when the room or the area that you are working in presumably is totally isolated?

The workmen are in their own special environment. That is required by OSHA, as we well know. And if you have air exchanging systems through vacuum, and we can put these up that you can develop up to 3,000 CFM and you can turn that air in that room every minute if you want through vacuuming, why does it preclude that that has to be wetted down during the process of removability, that if the gentleman was faced with a situation that had been previously encapsulated and then a decision that it had to be removed, why can't he control the environment within that structure to the adequacy of anybody's testing?

MR. MIRICK: If you are going to be able to control the environment completely, I think you could probably do a dry removal. However, before you do a dry removal, I understnd you have to have permission to do a dry removal, and this would take -- I would have to use a type C respirator for the worker or put the worker in an environmental suite.

There is no problem there. But if you are going to use the procedures followed today with a wet removal and you have encapsulated, you have problems.

VOICE: Doesn't the settling velosity change when it is dry as opposed to wet?

MR. MIRICK: That is a definite true statement. When they are dry, they take a lot longer to settle than when they are wet. But you are having air exchange systems, so you are pulling those fibers out, so you shouldn't have that problem if you get a complete air exchange.

VOICE: But you would still need permission?

MR. MIRICK: From what I understand, you do need permission.

MR. DORSEY: I have not seen the air data and the tests to support the idea that the heppa systems are 100 percent effective.

VOICE: We did this in an area on a complete takeoff with this situation going on and it came up zero. Every person there had the devices on himself. Outside the air where nothing was being conducted, they had more asbestos than inside.

EPA was there and an outside agency conducted the tests, so there is efficacy to the system under proper controls.

VOICE: Was that analyzed?

VOICE: Yes. I am not much for optical analysis. There is a human element there that I don't completely trust. Again, qualitative, who is the person, what is his experience and how am I to accept his judgment as being a valid one.

The results of the residuals have been presumably captured by the air sampling. And they come up zero.

Not 0.001, zero in that area.

MR. HUBBARD: X-ray refraction is not a good technique.

VOICE: It is a supportable technique. You can go to extremes and then it gets out of hand. So you conduct the best that you can, as best as you can, pardon the pun, that meets the situation, and which would indicate good control factors if the results are reasonably positive.

MR. HUBBARD: It would have been nice for you to have a few samples done with a TEM. It is expensive, though.

VOICE: Tom Diguardson, Carbolite.

Mr. Dorsey, I guess this should be directed towards you.

Are there going to be any guidelines directed towards the limit of liability of the suppliers of possible sealants? When we were talking just a short time ago, we were saying that after the material had been coated it was giving off more fibers than in the past, is there going to be any guidelines as to what a manufacturer is going to be liable for in terms of court cases 20 or 30 years down the road?

MR. DORSEY: Again, areas of responsibility, as an agency we are attempting to promote the research and dissemination of the best technical information available, but we are certainly not in the position to dictate what will happen as far as your use of a product in a specific situation.

And it would be impossible to task anyone if we could do that. Under the Toxic Substances Control Act we have the authority to regulate control of various hazardous materials, but certainly not the legal liabilities, which dictate what you can and cannot do with your product.

VOICE: Should we offer any guarantees or warranties on the material, then?

MR. DORSEY: I can't answer that for you. I can say as an agency if we find certain materials work and are effective, we can promote certain protocols saying if you follow these your chances of success are high, then that is what we will do.

MR. HUBBARD: Your problem there is that your people who are using your product are liable, and they are going to want to -- want you to relieve them of their liability, and so for that reason, not for EPA or regulation, you are going to want to have some sort of guarantee.

VOICE: Only to the point that you meet the government requirements in terms of the safety, and if it is one fiber per cubic centimeter, then the guarantee would presumably reach that end.

MR. MARTIN: That is not necessarily true at all.

VOICE: Then what would be the criteria to use, zero?

MR. DORSEY: I am not sure there is a magic standard as far as exposure levels. The two fibers per cubic centimeter is a workplace standard. The OSHA act is not strictly a health standard. It is a work practice standard.

So I don't think you can apply that as a strict health standard in any situation or exposure to asbestos.

VOICE: What position does the government take in terms of exposure aspects of fibers that they would consider safe?

MR. DORSEY: Well, I have a risk assessment document that I will give you a copy of. We have gone through and collected voluminous numbers of researchers and documents concerning health effects and levels, et cetera, and we have a compilation of all of those papers.

I will share that with you. At this point I don't think you will find that there is a magic number that people feel comfortable with. I don't think you want to say two fibers is safe for you.

VOICE: What is the government position in this?

MR. DORSEY: The OSHA regulation, which is the only position at this point is two fibers per cubic centimeter, but you have to understand how that standard is set.

MR. MARTIN: What do you put in specifications then after final clean up is accepted?

MR. DORSEY: I don't know.

VOICE: EPA is not going to come up with standards using PEM or SEM analysis on samples because there is too much variation of sampling technique. Until they do a round robin amongst the different labs and get levels where they are basically going to be compatible with one another within a factor of two, we will never see levels.

This amount, say, 100 fibers per cubic centimeter is going to be acceptable or not acceptable. The only levels that have ever come out is at Mt. Sinai.

Dr. Sillocoff said 45 nanograms per meter of air he considered acceptably safe. That is the only place where I have seen that printed.

But you are not going to come up with a level.

VOICE: Even in the removability or encapsulation, there is a certain element of risk involved and they will never get anything done in this regard.

VOICE: There is not enough information. Until you get a standardization and technique, and you are dealing with mostly with somebody looking under the microscope, right now there is only a handfull of labs that are expert in knowing what they are doing.

Even those disagree with one another. In a sampling of air, we had variations anywhere by a factor of a thousand on the same filter.

VOICE: What would be the responsibility of applicator or a manufacturer of the material?

VOICE: Use an OSHA standards because that is the only thing you have.

MR. DORSEY: The OSHA standard does make sense. It says you can't violate two fibers per cubic centimeter. You are also wearing a respiration mask. With the NESHAPS regulation, that is what we said was appropriate. Nobody is going to give you a magic standard.

It is not like we are dealing with a water pollutant where we can kill 50 percent of the goldfish and say that is an acceptable level.

Working with asbestos, I don't think we can measure a level and say that you are completely save, but following the OSHA work practices, using the respirators, using them in the water, we have tested and we say yes, that this is acceptable today.

That doesn't mean that the two fibers per cubic centimeter is a health standard or that anybody out here exposed to two fibers per cubic centimeter is necessarily safe.

It is not a health standard. If you are working with asbestos, there are certain precautions that have to be followed. The respirators, you have to be careful about contaminating the rest of the environment, the plastic around.

VOICE: If a facility owner comes to this conclusion, and he says I want zero after the encapsulation or removability throughout this whole facility, how could you possibly give him that assurance that he is going to get that?

MR. DORSEY: Zero, is that really attainable?

VOICE: Absence of any asbestos in the atmosphere by any testing.

MR. DORSEY: Do you have controls on the ambient environment to measure against what is happening in the building? That might be one way to convince him that you are at an acceptable level, because you can probably measure asbestos if you want to in the ambient environment outside the building.

VOICE: This is all a little confusing for me. I hear early this morning statements saying that there are safe areas where asbestos is present in existing facilities. I have seen numerous specifications come out in the public sector where they say meeting all EPA criteria, and that is all they leave it at.

Specifications are not laid out specifically. In comes a painting contractor bidding on these projects, my question is that if they say meeting all EPA requirements and they were below two fibers per cubic centimeters, are we required to go through all the preparatory procedures outlined in your dockets?

MR. DORSEY: It is a little confusing, what you have said.

VOICE: I have seen a lot of superintendents be very confused on this same issue. They say we are treating it as asbestos, but I want you to know that we do not have a problem. What that opens it up to is they are looking for a painting contractor to alleviate the liability, and as long as they are not above two fibers per cubic centimeter.

MR. DORSEY: As long as they have the non-friable material, there is a great deal of material out there under a wide range of conditions and there are degrees of friability. There is a tremendous amount of cementitious material. We will probably go through a building, survey it, if it is cementitious, is in good repair, is not going to be disturbed, we would say that is not a problem today.

You want to manage that material. You want to periodically inspect it.

VOICE: What if they chose to treat that material and they are below the two fibers per cubic centimeter? Must they adhere to your procedures for effecting asbestos containing sealing?

VOICE: In other words, a plastic application on the walls, the ceilings --

VOICE: Respirators, what-not.

MR. DORSEY: I have not encountered that question before. Ernie commented that they should actually test the application, the type of sealant being used. I would be conservative and recommend that they put up the plastic. If there is asbestos material and they are going to spray it and work with it, I would take the precautions.

VOICE: But they are not required. What is happening in the bidding process is that you have people going out there with no intention of doing that and basically preparing the bids, running through all the proper preparatory procedures that I feel is necessary, because you are disturbing that with high pressure spray and increasing those amounts, you are opening it up to fly-by-night organizations coming in and basically treating it as they would any normal ceiling structure.

MR. LORY: This is where air monitoring in the contracts, if you air monitor the beginning of the operation and finding the contractor is kicking off the asbestos fiber is greater than two fibers per CC, then by OSHA regulations his personnel will have to put on the proper respirator.

VOICE: That is only required during a removal operation.

MR. LORY: No.

VOICE: If you are putting that up in a spray, you are going to have one hell of a housekeeping job to get this off the floor and walls. Some you can't even use organic solvents to take that off. You have to sand it off.

MR. MIRICK: I also feel you should use the plastic when you are doing a barrier type system. If you are working with asbestos, you should use the barrier system.

MR. MARTIN: The medical monitoring limit point one, if they exceed point one or greater, they have to maintain medical records on those people.

VOICE: Almost anyone will preclude that the insurance company will want that. There is a lot of contingent liability involved with this ten years hence.

VOICE: I think what the gentleman was saying that the specifications are written too vaguely to begin with, and all the guess work and procedures are left up to the contractor, you would never get accurate bids out of this contractor.

VOICE: For the project, yes.

VOICE: That is why it is very important to get the specification prepared to the right rate and actually put the procedures in the specification. The engineer has to do some guess work in advance and say, okay, it can get this bad, I am going to specify that the contractor has to do this and this way he can be pinned down, and not leave anything up to contractors.

VOICE: I feel that is the responsibility of EPA --

MR. DORSEY: Chapter 9 of the guidance document has the minimal specs, plus the regulations are in the appendices. Working with ASTM, these are being revised. Many times a contractor is not aware of that suggested spec in chapter 9 or they are trying to bid without including the specs there, and they will have a low bid.

We are having problems with people that are definite asbestos exposure problems out and there and corrective action should be taken.

We are having trouble getting people to follow the requirements. Some of the suggestions that we hae made in our guidance documents are not law, but they are highly recommended.

They are suggested specs in chapter 9, the guidance document does detail procedures. It is very, very difficult to get people to follow those specs.

In situations where we say you do not have to encapsulate, remove, put up a barrier at this time, and they still decide to take an action and encapsulate, it is very, very difficult to convince them that they have to follow the procedures.

Anybody working with the material, any time you are in proximity of this sprayed on material, you can disturb it very easily and it can be the cementitious type.

VOICE: How successful has the encapsulation been in your getting out and taking your test samples of an area that has been sprayed? Are you finding around up on top of the beam and inbetween bar joists that you are not getting a sufficient spray?

MR. MIRICK: Basically, I have not seen a large amount of encapsulation work. I have seen and looked at some jobs, but I have not been out where I could look at applied jobs. This is one of the further parts of the program we would like to pursue further, that I get out and look at a large number of jobs to evaluate how the encapsulants are being applied and used.

I have done a couple on field studies and a special trip that I hae made for EPA.

VOICE: In the bridging type, the slides shown this morning, the large voids that were left, is it possible for fibers to sift and find their way out through these voids and bridging agents?

MR. LORY: Again, in that cursory study we were trying to look into the voids to see if the fibers within the voids were encapsulated or not, and according to our initial observations, we could not -- in several cases we found fibers that were not encapsulated.

In other cases we could not see well enough into the voids to determine if the fibers were encapsulated or not. Some of those voids that you saw on the slides which I presented were 100 micrometers across, which is 20 times greater than five micrometers, so we are talking about sometimes rather large holes.

With respect to the five micrometer size fiber, but to the human eye it is maybe a pinhole. So I can't answer your question, will fibers come through those holes or not.

These were some of the areas that we are pursuing.

MR. HUBBARD: In the observations that I made, now I wasn't looking at the surface for holes, but in the cross section that I made and I noticed a number of voids through the cross section, but those voids did not make a network of voids through that bridging agent.

Rather, they were individual voids in the material, gas bubbles, whatever, that were left there. But there was no network by which a fiber would find itself way out in those that I looked at.

VOICE: A question perhaps for someone that is involved in the business of removing it or encapsulating it. Comparative cost of encapsulating, say, a flat surface like over top of a swimming pool as compared to removing it. What is the cost of encapsulation? Is it 25 percent less than removing or --

VOICE: I would say approximately that, possibly a little bit more. Usually you have a lot of angles to overcome when you are spraying I beams. Talking about a flat surface, it is tremendous.

I think the cost factors can be significantly higher. Percentages, I recally can't give you without looking at a specific projection.

One thing I will say is that I have done projects where they have removed it and have been required to wipe the facility down and have removed it from I beams and structures and they found out a month or two later that they had higher levels of exposure than before, why have they not when EPA drew up the guidelines, in the removal process, why do they not require once it is wiped down that a sealant be applied to solidify the residual materials present in the system.

You can never remove 100 percent of these materials to my experience.

VOICE: I was going to ask this of you because in Virginia now they are starting to do this. After they have removed, they are coming back and spraying.

VOICE: I think that is wise.

Pittsburgh Wheeling and Steel had the same problem. It was necessary later to go back and solidify those residuals.

MR. DORSEY: It makes sense, but many times you have to apply a substitute. If you remove the sprayed on material, you spray something else up there.

VOICE: Yes, but, for example, a building that has been taken over by a new, and they do not have the same requirements as the old tenant in an existing facility, remodelling procedures, a lot of times that is not done.

MR. DORSEY: We have found problems where people have not cleaned thoroughly.

VOICE: That is the human element, again.

VOICE: Do you think this would be a good recommendation then in your guidelines?

MR. DORSEY: We are recommending that after you have removed or encapsulated the asbestos that you wash allk the surfaces, allow it to settle for 24 hours, go through and wash again and allow it to settle again for 24 hours. It is two cleanings.

VOICE: I can get cost breakdowns on it, two similar existing facilities and encapsulation.

VOICE: Then another question, what are the other states saying as far as encapsulation or removal?

VOICE: It doesn't work that way. In the

removal processes they mentioned, in Hawaii they started on that premise and now are taking a step forward rather than backward and are going to encapsulate because of the problem of having residual particles.

VOICE: I participated in the first seminar in Hawaii several years ago when they were considering products and I brought to his attention several products that were not tested by Battelle Labs, but what I considered some of the best in the field and they told me unless it is approved by Battelle, we are not interested in looking at it.

Subsequently, they were not tested and two similar products were written into those state specifications. And because of the human element involved in applying those and the failure rates incurred, they basically reverted and said thesame thing as New Jersey, that we are opting for total removability.

MR. DORSEY: That is part of it, but I have been to Hawaii, also. It is interesting, Hawaii had unique problems with their schools. They started off with extensive encapsulation work.

Then they discovered they had a number of schools that had a great tendency for water damage. Another problem is the high humidity in some of the areas and the rain. It is very, very difficult to consider an encapsulating agent in those areas, so they backed off considering using encapsulating agents.

I think recently they have gone back and surveyed their schools. They have removed in a number of the schools but they are coming back now and are going to remove in a few and encapsulate a few. That has been a change within the last few months.

VOICE: How do you apply this reasoning, and there are two buildings in Philadelphia now, 36 stories, all in plenums, total removability. An impossible task. You would have to have trained monkeys to get into some of these areas to remove it.

Physically it is impossible to remove it withoutt the destruction of the building. The Air Force base in Ohio. Same thing. It is in a hospital unit. What could you do?

Nothing but encapsulate. Our response to this is 90 percent is better than no percent.

MR. DORSEY: Well, my first question would be, I would check the material, the condition. The first thing I would ask is what is happening in that air plenum. I have been in buildings where there is a great deal of activity in the air plenum and a number of construction changes taking place in the air plenums.

In that case, I am not sure I would recommend an encapsulating agent. If they couldn't stop the activity -- many times you see the sprinkler systems going in, the conduits are being changed, communication lines, computer lines, et cetera, and it is disturbing a great deal of the material in that air plenum.

In that I would recommend if the material is basically in good condition that they not disturb it anymore. If they have to modify the building, they do something other than disturbing the asbestos.

VOICE: The other peripheral elements are already in there.

MR. DORSEY: In many buildings I have been in today they are in good condition. Is the material in good condition?

VOICE: It has been tested that high contamination release of the materials has been effected.

MR. DORSEY: Through what, air monitoring?

VOICE: Yes.

MR. DORSEY: What levels are they finding?

VOICE: A high content of asbestos in the atmosphere.

MR. DORSEY: What are the levels?

VOICE: They indicate exceeds what the minimum requirements were on the exposure of two fibers per CC.

MR. DORSEY: I would like to see that. There is a building in San Francisco with problems with asbestos and a difficult building to remove. Unless the material is being disturbed, we have problems violating that two cubic CC standard.

VOICE: A graduate school in New York City, 60,000 square feet in their laboratory and their cafeteria. I stuck my head in there and you can grab handfulls off the drop ceiling. It is a plenum.

You can actually see it coming down and hanging in streamers. You can blow and see the stuff come floating down. I wouldn't even hesitate -- if they took another sampling test on that, it would be out of this world.

MR. DORSEY: But applying an encapsulating agent, would you apply an encapsulating agent?

VOICE: We backed away from it. The same thing with a situation in Staten Island College. You have a 16-story building, exactly that condition. They have been trying to bypass it. They said we want to encapsulate. We backed away.

That is being culpable, really. May I ask one other question?

At what physical state is it all other physical states in terms of size of the asbestos fiber or fibrils that would be considered carcinogenic?

MR. DORSEY: What do you mean?

VOICE: If you have in excess of five milimeters or smaller and down to a dust factor below even micron size, spherical in nature, say, from automobile brake linings that are being released all over the country, would that be considered carcinogenic, the release of this material into the atmosphere?

MR. DORSEY: At one point there was a recommendation that the fibers had to be five micron, up to a range of nine, some said 12, that these are the fibers that caused the cancers.

Today I think the researchers have changed their mind that all fibers are suspect.

VOICE: You wouldn't be discussing a fiber in the ase of an automobile braking system?

MR. DORSEY: I am sure that there are asbestos fibers released that that could cause problems. Some studies have shown with the heat and the changes, there are fibers that have to be released from the brake lining. I don't think those are the same fibers encountered in these buildings. From simulation studies, we have shown that there are elevated levels.

If a janitor is changing a light bulb, some will be disturbed. If a student is going to gouge a handfull, you will see some falling off.

VOICE: Any physical state of the material being emitted inside of a building then would be considered carcinogenic in nature, can induce --

MR. DORSEY: If you are talking about levels --

VOICE: No, We are talking about the physical state of the material.

MR. DORSEY: Yes.

VOICE: John Met, Plexoflec Corporation.

Listening to Dr. Sawyer, to answer your question, his comment about a year or a year and a half ago at a conference down at GSA here was that there are no safe levels of fibers for carcinoma. However, he would go ahead and say that there was some safe level for asbestosis, which is similar to black lung disease.

If that helps you any, that is fine. I have attended many of these things over the past three years, and I wish I could say I see progress, but I really don't. Where do you see the program going?

We have as a corporation assisted the State of Virginia in writing up guidelines for encapsulation; Maryland; the City of Washington, D.C.; the City of Baltimore, and we end up making judgments basically at some point without much help from anybody.

And I suspect that many people in this field, including this gentleman here who is an architect is asked to make judgments. I know he is reaching for answers.

But there is nothing that you can sink your teeth into. Do you feel that there is going to be a point, anyone of you, that we don't talk in terms of there is a tremendous variety of asbestos, we have a tremendous variety of application technology, so we have a difficult time talking about that.

We have a problem in fiber counts, not just counting it, but in establishing a test method for counting it. We have a probelm in identifying what should be removed or what should be encapsulated.

I can keep going. Where are you going to get to?

MR. DORSEY: I disagree with the statement that we have not made any progress. But the other point that is made is that we do not have all the answers. The reason for this conference today is that I would love to have complete guidance documents, and I would love to be able to give you definitive guidelines on the use of sealants.

I don't have it and no one else has it. We have made progress, but I don't have all the answers for you. I am hoping to share what we have or don't have and share the experience with you maybe to learn something.

Resarch is still needed. I think with the protocols we are going to suggest to be developed in the next few years, it will be a step forward as far as testing the material and the substrata, but I don't have the answers.

As far as the program, I know twice as much about this problem as I did two and a half years ago when I started the program.

The guidance document has been widely distributed and used. Others in the business, the other programs around the country, and there are people here that have conducted outstanding programs, and I have learned a great deal from them also.

Chris Williams is here from Maryland. We have made advances. The guidance document is available now, the one on the sealants that is available to you. It is certainly a step forward.

I did not have that a year ago. I know more about sealants now and what they do and don't do, where to use them and where not to use them than I did a year ago.

We have a system now that I think we will be able to take long term air monitoring information and corro-late with the findings of the study and give you that information.

VOICE: I didn't mean to raise your ire on this. I am sure you are putting up with a lot of us picking this thing apart. I am trying to say yes, we do have more information, we are all getting experience in this particular arena.

I guess what I am asking is when is -- when are we going to see, for example, a list of sealants, encapsulants, that either somebody someplace more knowledgeable than most of us in this room, such as this gentleman from Georgia Tech or the U.S. Navy or Mr. Mirick from Battelle Labs, that will say this is not a list of things that we have tested them and we think they will work but don't take our word for it, they are not really recommended, but they are, so we are in a position where we can use it, but we don't have to, but then it is a good idea, because we spent three million dollars doing it.

MR. LORY: Could I add something? Several points that I made earlier this morning, and I think have been brought up several times this morning besides myself and this afternoon, is we do not have currently, at least the U.S. Navy does not currently have a good system for inspecting the friable insulating material to determine if it will accept and encapsulating agent.

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MR. LORY: That is number one, is to determine if the asbestos-containing material is actually a good candidate for an encapsulation.

Number two is that currently we do not feel like we have a good method of writing a type -- quote, unquote -- a type spec in the Navy that will insure that the contractors bidding on it and that the contractor is going to do the job that is acceptable for the encapsulation.

Number three is that we do not have a good method of determining if the application is acceptable. This has been mentioned several times before. One gentleman said that he had an engineering group that was capable of determining that.

Fine. He has one, maybe that is one of the few in the whold world that is capable of doing that. But in the Navy we are trying to standardize the system so that the 200 activities or more, that we can have a standard system for inspection.

And so we have got the problems from the user's side as well as I realize you people on the manufacturing side as well as the contractors as well as the architects. We all see the problem from different lines. We are trying to put it down on paper.

I have met many times with various people here in the Washington D.C. area, with the painters union, somebody as a go-between, but with the painters' union and various other people who actually apply paints, sealants, encapsulating agents, and trying to find out, is there a good standard technique, is there a good application technique?

We have yet to come up with some good information that we have got some paint manufacturers saying this is the way to do it, that is the way to do it, but yet when we try to put it down on paper and try to use it as a generalized method, it falls short.

So it sounds like I got more questions that I have answers, which is true, but we are pursuing these areas. They are not dead in the water. They are being pursued.

It is just that meetings like this is where we are gaining our knowledge, and I would like to see more contractors, possibly tomorrow, express their experience. Some of them won't say anything, because they are afraid that their competition sitting there in the audience is going to say, hey, that is what Joe is doing and it seems like we can do that, too.

We found this out in several other meetings where architects refused to talk about their specifications and talk about this and that because they don't want their competition to hear.

But I hope you appreciate from the Navy's standpoint that we are trying to gain this knowledge so that we can use it in the various Navy activities around the United States as well as around the world, and not try to re-invent the wheel.

It can take an architect and engineer two to three months to get up to speed to write a good, tight specification. That is a lot of time involved in writing a good specification. The Navy has developed a guidance document and writing a specification. It is not perfect. It is a system that the engineer/architect can start out. It is a stepping stone, and then they can apply it to their own particular requirements.

But we have questions, we have a few answers. But this is where we are learning as well.

MR. DORSEY: Let me state the purpose of this meeting was to share our research findings and also solicit ideas and suggestions from you.

Again, it is research, and there is a lot of problems. There is a lot more work that has to be done. If it were as simple as if we had the answers we could give them to you, you would have the guidance documents and that would be it.

VOICE: I would like to agree that we have come a long way since the time the EPA came out with those guidance documents. We used them in New Jersey and came up with our own minimal specifications for removal of asbestos. We also have a course for the contractors who want to do the work, which, again, the U.S. EPA helps us with.

So I think there has been a lot of progress. In the case of encapsulation, we saw the problems in New Jersey a couple of years back and we decided the best thing we could do for our constituents there is at this time we do not recommend the use of sealants at all, as most of you are aware. Tomorrow we are gonig to have a couple of panel discussions, where a lot more of the field experience and other experience will be brought up.

I would ask a question of Mr. Lory. In these five or six test cases, could you visibly tell that the sealants were not doing the job, or in other words, the holes that you saw in the SEM, could you see that there were some problems by looking at them visibly?

Also, not being familiar with the actual practice for SEM, these surface samples, are they small portions that you cut off, are these large sections that you cut off?

I wasn't quite clear when you look at it in the SEM. I know you tried to discuss preparation earlier. One question for the gentleman over there who has had a lot of questions himself, in those places where you said people can't physically get to it,how would they be able to encapsulate it?

VOICE: There are extension tubes that you can put in where cockroaches will go, but no human being. There is too much regidity and the interface adhesion is too strong for high vacuuming procedures.

We have done it where sheer factors would indicate that the surface characteristics were highly friable and loose, but the inner-structures of it were quite solid and we removed these from the surface and encapsulated the rest with good success, and they have been in in excess of 10 years and are still functioning.

VOICE: What sheer test did you use?

VOICE: The sheer material, because of, I suspect, the atmospheric pressures, a failure of the binder has occurred on the outward phase of the material. You can grab a handful off, but you can't take it off the substrate completely.

That half inch section is relatively loose and easily removed. That obviously would preclude no application --

VOICE: No, you said you did sheer tests. What test did you use?

VOICE: The sheer phase.

MR. MARTIN: What test did you use to determine the sheer capacity?

VOICE: You can reach up and release it from the surface with your hand.

MR. MARTIN: It is not a standard test?

VOICE: No. There are so many constituencies involvd with the total asbestos matrix, it is almost impossible to establish a standard.

MR. LORY: Number one is that the size of the sample is very small. The samples we use is something probably smaller than your smallest finger, thumbnail. It is very small.

Maybe Jim can give a better description of size.

MR. HUBBARD: Actually in the test that I used, it depends on the scanning electron microscope. My new one, I can put something in there three or four inches in diameter and an inch thick and on my samples it was the full thickness of the material, which happened to be only a quarter of an inch, but if it had been two inches I could have put that in there.

Different SEM's hold different sample sizes, but the SEM is capable of magnification as low as ten times, so that you can in effect look at large areas and magnification capable of 70,000 times.

MR. LORY: Let me clarify mine, too, Jim. What I was stating was that was the surface area, but we do -- at least that is how our technicians prepare, abot a quarter inch in diameter, but the full depth of the material. So we did run when possible the full depth of the material that was present.

Your other question concerning field observation versus SEM, a comparison, I would not want to make at the present time any field judgments. I do not feel I am qualified.

I have seen a number of applications, but I would not make any field judgments because I am not --

VOICE: The reason I asked that is because EPA said that field testing should be done before you decide --

MR. LORY: Yes, but this is exactly what I said, but I am also saying that we have not come up with the protocol for doing field tests. It sounds like, do it, but we don't have the method.

MR. DORSEY: We are working with ASTM to develop these protocols, but they will have to be tested and that will have to be sometime in the future.

VOICE: ASTM is a test method. Who is going to set the standards as to what is a pass or fail criteria? ASTM writes tests and test methods. What is a pass or fail on that test?

MR. DORSEY: But the test will be does the encapsulating agent successfully encapsulate the asbestos-containing material.

VOICE: Who is going to be the specifying body to say yes --

VOICE: You have to certify it. Just like you do now. Just like a federal specification. You certify it. So long as you certify it, your neck is on the line.

VOICE: ASTM does not certify.

VOICE: I am saying the manufacturer will have to certify that he is in compliance with the ASTM test method?

VOICE: The test method is just a test method. Who is going to be the specifying body to say this is a minimal acceptable performance on this test method?

VOICE: That the material is suitable for the intended purpose.

VOICE: Right. What we are looking for in essence is the four or five tests that Bill talked about earlier today, he says this is the kind of test that we do and this is what we are looking for, smoke generation, what not. There can be an ASTM test on each of those, but is there going to be a specifying body saying we want no more than ten percent smoke generation or zero flame spread or whatever.

VOICE: Who is going to be specifying that for the entire industry?

MR. MIRICK: On those specifications, the smoke generation, the toxic gases, the percentage of those and the flame spread rating are based on HUD standards that specify for interior spaces, that they cannot exceed these points. And those are specific HUD standards and are outlined in the final report.

VOICE: Would that be considered a class A treatment?

MR. MIRICK: A class A treatment.

VOICE: What about fire resistance, the effect of these sealants on the fire resistant capacity of the coating, the original coating?

MR. MIRICK: Fire rating is one of the things the ASTM committee is studying and there will be a gentleman here tomorrow, I understand, from UL. He can speak to that tomorrow about what they are planning to do on that. The flame spread does not mean the fire classification. The flame spread is a different test, strictly a single test.

VOICE: It seems to be a practice as of late that certain municipalities, various health departments, I just heard it here now, it is like a cleansing of the soul.

It is easy to advocate total removal of anything because you have advocated total removal, but in reality you are not going to have total removal. A lot of people won't want the cost, so you are not going to hear about it.

I don't get inquiries from New Jersey. I will get them from New York State, Maryland, Kentucky, throughout the United States, but not from New Jersey.

Does that mean everbody has taken care of asbestos in New Jersey and removing it? No. People find out they have a problem, find out what the cost of removal is and you don't hear about it anymore. If you think you are going to remove all of this, you are not going to do that. As the gentleman said about the intricate patterns in the building structures, nobody is going to remove that. Even if you did do it with any degree of success or marginal success, you would have residuals all over the place.

So I don't understand how one can advocate complete removal.

VOICE: In New Jersey we have a program in my program itself, that there are people who go out and do inspection and when we find a problem they do correct it. At least we do not have a problem with something saying they are not corecting it yet.

Sometimes it is a localized problem. They can do encapsulation. We have nothing against encapsulation if it can be done.

Sealant used, as we said a few years back, there were too many questions unanswered and we were actually saving them the cost of doing it and found out two years later they had to reseal it or remove it, at which time the cost was much more.

Some people did remove it prior to our decision about the sealants. They have tried it and they have failed in those places. That is what we will be discussing tomorrow.

VOICE: What would you do if you ran into a situation that the condition would be literally impossible to effect removal?

Do you throw up your hands and walk away from it?

VOICE: If nothing else works, yes. If that gives you a little bit more protection, ues it. I have to see a situation like that.

VOICE: Rutgers University took encapsulation four years ago and it is working.

VOICE: We haven't heard about that.

VOICE: Monmouth College is another, and thse are all state institutions.

VOICE: We will have somebody from D&P also who has more information.

VOICE: I am trying to inject into it that there are insoluable situations that one doesn't have to go to an expert to say how can I correct this asbestos, because I can get a janitor or somebody completely informed, can say it is easy, take it off.

If it were that simple there would be no problem in the United States. The government can print money like it has been. That is why we get inflation. We keep printing money and we can eliminate the problem by taking it off in the United States.

VOICE: We use the algorithm, we use our own experiences. We use all of that to decide and say well, you really don't have as serious a problem. Watch it to see if it becomes worse.

I have gone to the schools and told them you don't have to remove it, but there is so much pressure from the teachers and the parents that feel it should be removed anyhow.

So they get this time to work it out into their budget and we think that finally they are saving money by getting rid of it.

If the schools are going to take it out, we heard that in schools sealants are definitely not going to work.

VOICE: A superintendent has been appealing to a school in Trenton for two solid years and got no direction from them.

VOICE: The reason they were going to Trenton was to ask for money, not for help.

VOICE: It got into the congressional record.

VOICE: I am from Alperto. Can we make this more general than New Jersey?

MR. DORSEY: I ask that we stop the discussion for now. We have moved into some areas that would be great for the panel discussion tomorrow. I would ask the gentleman if they would like to convene separately and discuss the problems of New Jersey, fine.

If you have questions, we will have a forum set up tomorrow to answer that. This is the kind of exchange I was expecting, and I really appreciate it. Thank you.

(Whereupon, at 4:55 p.m. the conference was recessed; to reconvene at 8:30 a.m. the following day.)

REPORTER'S CERTIFICATE

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HEARING DATE: June 8, 1981

LOCATION: Arlington, Virginia

I hereby certify that the proceedings and evidence herein are contained fully and accurately on the tapes and notes reported by me at the hearing in the above case before U.S. Environmental Protection Agency and that this is a true and correct transcript of the same.

Date: June 18, 1981

Marcia D. Stein

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