OPENING COMMENTS OF SESSION CHAIRMAN

PANEL SESSION: CHANGES TO ASME CODE AG-1, SECTION FC, HEPA FILTERS

This session is on changes to ASME Code AG-1, Section FC, HEPA Filters. The participants are Jack Hayes with the US Nuclear Regulatory Commission, Jim Slawski, with DOE; Bill Rown, with the US Army, Edgewood Research Development and Engineering Center; Ben Franklin with AAF; and Steve Klocke with Flanders Filters. I am Rich Porco with Ellis & Watts. We are going to give each of the panel participants a chance to say a few words starting with Jack Hayes.

PANEL DISCUSSION

HAYES: As an introduction to this panel session I would like to provide some background on the changes which have been made to Section FC, HEPA filters, and the basis for making the changes. In March, 1994, the Department of the Army proposed a review of ASME Code Section AG-1 to determine whether it could be utilized in lieu of two existing military standards, MIL F 51068, for high efficiency particulates filters, and MIL F 51079, dealing with filter media. Based upon the review, the Army determined that the ASME AG-1 code, specifically, Section FC, could be utilized. In April, 1995, the representatives of Code Section FC met with representatives from the Department of the Army and Department of the Navy to discuss incorporating all of these MIL standards into code section FC. Previously MIL F 51079 and 51068 were incorporated into the code by reference only. In addition, we wanted to discuss with the Departments of the Army and Navy the rough handling test, use of challenge agents other than DOP for aerosol testing, and alternative HEPA filter frame materials (because FC was initially limited to nuclear power plant applications and did not incorporate some of the frame materials in the Army standard.) We also wanted to talk about the acceptability of laser spectrometer testing for filter efficiency and, finally, we wanted to discuss seismic and environmental qualification. I might add that these discussions with the Departments of Army and Navy representatives were quite useful in developing the changes which were ultimately made to Section FC. Now, I am going to highlight important changes made to Section FC that I think will be of interest. We have defined an independent filter test laboratory. It is intended to allow any entity not associated with either a filter manufacturer or a supplier, that is capable of performing the laboratory tests called out by code section FC, to do so. This was done because Edgewood, the Department of the Army facility, may not continue to do this type of testing for others. We defined "test aerosol" to allow substances other than DOP.

I will now break the changes we have made to Section FC into two categories: first, those associated with the incorporation of the MIL Standards, and second, the changes that are independent of the MIL Standards. The MIL Standards have designations for framing materials, including one for plywood. Section FC did not previously incorporate filter designs using plywood but we now have direction from the Board of Nuclear Codes and Standards of ASME that we must broaden our code application. Therefore, we can not restrict the code to nuclear power plants applications alone, but must provide code assistance to other entities. That being the case we have added designations from the MIL Standard that will cover plywood. In the MIL Standards separators must have the ability to withstand corrosion. This aspect, as it applies to DOE-type applications, has been added to Section FC. We also added a new filter size to Code Section FC, a12x12x11.5 in. filter, referred to as "size nine". It has a design flow rate of 250 CFM and a maximum resistance of 1 in.w. Because cancellation of MIL F 51079, is likely, mandatory. Appendix FC-1 now contains parts of F 51079, such as tensile strength. We also added a requirement for a certificate of conformance as a substitute for QPL qualification testing. Another significant change is to allowed qualification testing by an independent laboratory. We have also allowed the use of laser particle counters; previously, Section FC did not. A method for the filter rough handling test was added. We corrected the efficiency acceptance criterion for the heated air test. In the prior version of FC it was incorrectly stated as 0.3%. It has been corrected to 3%, and now it is consistent with the requirements of the MIL Standard. The radiation resistance section was deleted, not because it is no longer required, but because it is handled by another section of the AG-1 code. In early 1996, Section FC was balloted by the Board of Nuclear Codes and Standards of ASME and received three negatives. The comments associated with the three negatives have been resolved and we went back to the Board of Nuclear Codes and Standards to determine if

they had any further objections to the changes we made to FC. They had until July 5, 1996 to respond. It is my understanding that no objections were received and Section FC can now go to ANSI for concurrence, a thirty day process. After ANSI concurrence, Section FC will be available for use, but an official publication will not be made until the next addendum to the AG-1 Code. However, the revised version can be obtained from ASME or from Rich or me.

PORCO: I thought it would be appropriate to say a few words about ASME AG-1 Code and how section FC fits in. ASME AG-1 is an equipment code covering four general areas. Division I contains general requirements. Division II contains the requirements for ventilation air cleaning and ventilation air conditioning. FC is a subsection of Division II. Division III contains the requirements for process gas treatment. Division IV contains testing procedures. We are mostly concerned with Divisions I and II. Division I, section AA, contains the common sections that apply to section FC. The general requirements were pulled out of the each of the sections covering ventilation air cleaning and ventilation air conditioning equipment. Design criteria is one of the categories that is common. The division and section titles are shown in Table 1.

TABLE 1

DIVISION I	- GENERAL REQUIREMENTS
SECTION AA	- COMMON ARTICLES
DIVISION II	- VENTILATION AIR CLEANING & VENTILATION AIR CONDITIONING
SECTION BA	- FANS AND BLOWERS
SECTION DA	- DAMPERS AND LOUVERS
SECTION SA	- DUCTWORK
SECTION RA	- REFRIGERATION EQUIPMENT
SECTION CA	- CONDITIONING EQUIPMENT
SECTION FA	- MOISTURE SEPARATORS
SECTION FB	- PREFILTERS
SECTION FC	- HEPA FILTERS
SECTION FD	- TYPE II ADSORBER CELLS
SECTION FE	- TYPE III SORBERS
SECTION FF	- ADSORBENT MEDIA
SECTION FG	- FRAMES
SECTION IA	- INSTRUMENTATION AND CONTROL

PROPOSED NEW SECTIONS UNDER PREPARATION

SECTION FH	- TYPE IV SORBERS
SECTION FI	- METAL FILTERS

As can be seen from Table 1, CONAGT is very busy. Going down the list almost all the components, fans and blowers, dampers and louvers, prefilters, HEPA filters, Type II adsorbers (tray type) Type III adsorbers, filter frames, and racks are complete. There are also sections that are currently being worked on, e.g., Type IV adsorbers (v-type configuration), and Section FI on metal filters. Papers were given at this conference on metal filters; the code is active. The points to be made here are: (1) AG-1 is a code that has general requirements with common articles, therefore, Section FC is not a stand-alone document. (2) The code is interrelated with ASME N-509 and ASME NQA-1, which has the QA requirements. And (3)the code is a living document so we have active writing groups; not only in new areas like metal filters, but also for Section FC. The writing group currently is looking at ways of improving FC and meeting industry requirements. Therefore, suggestions made at this conference will be integrated into the code during the next revision. The writing group is made up of a cross section of industry and includes representatives from DOE, Army, Navy, Nuclear facilities, AE firms, and equipment manufacturers. If anybody is interested in participating in this code work, please give your name to any member of CONAGT. The code provides means for technical inquiries, both questions and concerns on how to apply the document. At the back of the code there is a mandatory appendix that gives instructions on how to submit questions. It is designed to provide a quick response to questions on the code.

HAYES: Prior to starting our panel discussion I would like to emphasize that this revision to section FC was done very quickly to avoid being left without documented guidance after military standards F 51068 and F51079 were voided. We have no more than just finished this revision and here we are looking to make the technical changes which need to be made to section FC. At the CONAGT subcommittee meeting on ventilation air cleaning equipment, we generated a list of about ten individuals who volunteered to participate in the revision. The changes so far just reflect correction of certain errors and recall of the MIL Standards. We would be interested in the participation of everyone willing to work with the committees and writing groups to make the needed changes. I think we are ready to discuss the changes to code section FC.

PORCO: Let me add another point. Some questions have been asked concerning design criteria. The code is different than the military standard in that it not only gives specific requirements for HEPA filters but also requires all the other design criteria to be addressed. For people looking for simple cookbook solutions, let me point out some of the other things the code and the standards require you to do. You need to address design criteria and environmental qualifications, volumetric air flow rate, minimum and maximum design pressures. In other words if you have a high design pressure, or a pressure-time transient, you must address it in addition to the requirements that are in FC. You must address how your filter selection is going to meet all requirements and determine if the filter specified in FC can meet it. When you have high temperature, entrained water droplets, or high relative humidity applications you must address them. Dr. Bergman has mentioned, time and again, the effects of entrained water blinding filters and causing failures. All the environmental conditions must be cited by the specifier, and the designers, or the engineers, must design the system and components to meet all the requirements. Other considerations, among others, are concentration of specific contaminants in the air stream, required decontamination factors, radiation integrated life dose, and structural loading. I repeat, you cannot use the code by just looking at section FC, you must also consider how the housing, fans, dampers, in fact, every component in the system, interacts to assure environmental and seismic qualification. The metal portions usually do not pose much of a problem, but the non-metalics definitely need to be addressed for environmental requirements. The

point that Dr. Ricketts made about different materials within HEPA filters was very important. There are also different materials within the houses that interact and affect overall system performance. The key is to have components, systems, and the complete air handling and facilities operation meet all the needs of your application.

FRANKLIN: I look forward to changes in the code. I think of the present code as an optimization of the HEPA filter, materials, thicknesses, et cetera, as it was thirty years ago. It does not pay attention to what the HEPA filter industry has become since then. At that earlier time, all HEPA filters were built the same way. Today, the Mil. Spec. or government specification HEPA filter for nuclear power plants are the least efficient filters we have. There are many other applications. I look forward to future modifications for handling new types of filters, and other types of applications. I think it will be a help to the industry. I see that European standards cover all kinds of filters, not just nuclear filters, in their standards.

KLOCKE: I think there is still plenty of room for improvement in section FC, although it is now very usable. Basically, it carries on our historical specifications without losing continuity. There are a couple of things that got dropped in the transition from the Mill Spec to section FC. They included the climatic exposure test which exposed filters to arctic, tropical, and desert conditions. These tests were not of major concern in the past, even when they were included by reference in DOE specifications. Most DOE customers would waive these specific requirements. Presumably they came from defense-related applications, but they are not of major importance or concern anymore. Other qualification tests, rough handling, wet over pressure, heated air, are still only required once in five years by an independent lab. Certainly, that's a long time to go between tests. We are very much a proponent of doing more testing of a lot of these design qualification criteria. However, there is not a lot of guidance for acceptance criteria on them, and it is certainly a point of discussion. We used to have to submit a very small number of filters, typically four filters for each type of test, to Edgewood, four for rough handling, four for the wet overpressure. You had to pass four out of four. Now, when we get into more routine testing of such filters, we obviously can't expect 100% compliance every time. Sooner or later, we will observe a test failure. How do we resolve it? What are the acceptance criteria levels to be used on a more ongoing basis? We need to discuss that and come to agreement through the consensus work of the committees and resolve the issues. Here is another point, we talked about media tensile strength earlier. The specifications still only require tensile strength of new media to be only 2.5 pounds per inch. I know that all good HEPA filter manufacturers of the nuclear grade filter are buying or manufacturing media that has twice or even higher tensile strength, right now. In fact, if you try to make HEPA filters for nuclear application with that low tensile strength, you can expect some failures on a design qualification basis. Therefore, there are many areas for improvement. We have to go back and ask why we adopted the old qualification tests, and then come up with a sound basis for what the new qualifications should be. A lot of work needs to be done by a lot of people in every area, from suppliers to users.

SLAWSKI: When I started working in this area, not long ago, one of the tasks that I picked up was to update the DOE technical standard on specifications for filters. And then I also got involved with CONAGT on the FC committee. We are definitely working our way to transferring to FC. I cannot say that we are ready to do that today. We have just had one more meeting on technical issues in the DOE draft standard, and are trying to get it to the point where it is compatible with FC. We have made some progress. We will do one more review and revision of the draft standard, and compare it, line-by-line, with what is issued as FC, and see where we are. I am just looking at the items discussed here this morning and I see that the DOE standard's reference to a size 3A seems to be the FC size 9,

and our pressure drop is higher than the value in the FC section, i.e.,1.3 versus 1.0. We have to resolve such issues. I think it is fair to say that except for the size 7 and size 8 there is a pressure drop difference of 1.3 versus the DOE's 1.0. We probably have a lot of tiny technical issues, and probably more in the area of what I would call "pick up errors", as opposed to "intentional errors", in pulling over the important parts of the Mil. Standards that have been dropped. That is what both ASME and DOE have to do, make sure that we haven't dropped things that we should pick up, and that we pick them up correctly.

ROWAN: There is also a correction in your program. As you probably know, we in the army have been custodians of MIL-F-51068 and MIL-F-51079 for over thirty years, plus the corresponding qualified products list (QPL). Of course we are vitally interested in particulate filtration in our mission to protect troops from chemical/biological warfare. However, this particular filter never really fit too well into the army's theme of management. When we develop filters, we start the configuration management system with a requirement from the field, i.e., they tell us they need such a filter for such-and-such a flow and such-and-such conditions, and then we develop the requirements from that. I am not really sure where all the requirements for MIL-F-51068 came from. I don't think anyone is around who was there when it was first developed. Another thing is that we have about six other particulate filters that we have Mil. Specs for. They were all developed in the conventional manner. They are procured with material procurement money and managed under a logistical system of inventory control and things like that. The MIL-F-51068 filters are used primarily in what we call fixed installation filter phases; they are mostly doomsday-type control centers. They are very highly secret. I do not know where they are and I don't even want to know much about them for fear I might disclose some information I am not supposed to. But it has been very difficult getting information as to what they need. We know they buy them, but we could never find out how many they bought. That is one reason we were unable to argue effectively against the canceling of MIL-F-51068. There is definitely a need for it. We know those installations are buying them regularly. We have a representative who serves as a point of contact with them, and we are going to have to use AG-1 for their purposes. There are several things we are going to have to undo in order to accomplish this, or make some kind of compensation for it. One is in MIL-F-51079, the text of which is being appended in AG-1. Things like mildew resistance and environmental resistance where left out. We will probably have to get them reinserted or make up our own document for our customers because they want them. The bottom line is that we are going to take a very strong interest in this in the future, probably much stronger than we did in the past. We know the requirements are going to be driven primarily by nuclear needs, but we have our own needs, and we are going to need this document.

PORCO: Thank you. I think we can now open the floor for general questions.

DISCUSSION

FRETTHOLD: Will a list of qualified filters be kept, and if so, by whom, or will the certification of conformance be kept by the manufacturer in lieu of the list?

PORCO: I think the issue here is not understanding the current code. The code requires you to have a QA program in accordance with ASME NQA-1. The NQA-1 program requires each manufacturer to have an auditable quality program that is in compliance with eighteen criteria. They include auditing, design, purchasing, and engineering, encompassing every facet of the facility. That program is the key here. In other words, manufacturers will have to have a program that is in compliance. They must be able to defend that program, it must be auditable. The purchaser may choose to audit them to make sure that they are in total compliance in order to have positive proof that all the qualification tests were performed and all the material certifications, *etc.*, are in place. Or they may choose to use a group such as NUPIC, a group of utilities that have come together to make auditing and verification a little cheaper. If You subscribe to their service, they will provide you with all the audit reports. The bottom line answer is no, there won't be a list.

GRAVES: If I am a nuclear utility, for instance, and I need to design, have built, and then commission an air cleaning system, what would you recommend I use, AG-1 or N-509? Are there any regulatory implications if I have to live with Reg. Guide 1.52?

HAYES: Our recommendation would be that you have to incorporate both AG-1 and N-509, because at this time I don't believe AG-1 is complete enough to exclude N-509. Once the code is completed, you will be able to utilize it exclusively, but until that time, it will still be necessary to use AG-1 and N509 as part of your design process. With respect to the acceptability of AG-1 to a regulatory agency such as the NRC, the NRC has already endorsed part of AG-1 in the implementation of improved standard technical specifications. Also, I believe, as part of the review of some of the advanced light water reactor designs such as the AP600 by Westinghouse, the Combustion Engineering System 80, and the advanced BWR from GE. So I think it has been incorporated into the advanced designs and would certainly be acceptable for consideration by any operating facility if they wanted to do a back fit to their existing ventilation systems.

FIRST: Let me get on to another topic, one that I have presented to sessions of this organization in past years. It refers to the efficiency requirements for HEPA filters used at nuclear facilities. The original efficiency requirement was for 99.95%, with 0.3 μm DOP. This requirement originated in the early days of the filter. Then in the 1960s, approximately, the minimum acceptable efficiency was raised to 99.97%. The question is, why was it raised at that time? I can assure you nobody did any research on the subject, it was a very simple matter. All of the manufacturers were sending in filters that were at 99.97% or above. And someone wisely said, why don't we raise the criteria since it is not a problem for the manufacturer? Here we are, thirty years later, and what we find in practice is that the filters that are sold for nuclear applications have minimum efficiencies in excess of 99.99%. My request to the committee is that they take this to heart, and that the revisions to this HEPA filter section recognize the fact that we need to raise our sights. Inasmuch as the filters already come through that way, anyway, is it important? I think the answer is, yes, it is, because we have people who are critical of the nuclear program who will be likely to rub our noses in the fact that we are not using standards that represent the best that the industry can produce. I think it is very important that

we recognize advances in technology and that we make this change in the definition of the HEPA filter for use in nuclear applications.

PORCO: Very good comment. I think we have a few panel members that want to respond as well as a few people in the audience.

KLOCKE: First, I want to point out where these higher efficiencies are rooted. In this industry, contrary to a lot of other ones, we have both a media specification and a finished filter specification. MIL-F-51079 very clearly points out that the minimum efficiency for the filter medium must be 99.97% for 0.3μm particles at a velocity of about 10.5fpm. It has been that way for many, many years and unchanged since the original specification. Most filters, on the other hand, are designed with a maximum media velocity of only about 5 fpm. As theory predicts, by reducing the flow rate, efficiency improves. So, when we start with media that perform well at twice the velocity used in the filter, we get the natural benefit of increased efficiency when we operate them at something less than 5fpm. These days, most designs have enough filter area that the velocity can be significantly less than even 5fpm. Also, media manufacturing technology has certainly progressed well beyond the basic minimum efficiency of 99.97%. We have the capability, as we saw on slides in earlier presentations, to make filter media that are two, three, four orders of magnitude more efficient than basic HEPA filter media. Obviously, pressure drop increases go along with it. There is always a cost/benefit issue here that needs to be addressed when considering choices of higher efficiency filters. Another thing we have talked about, but breezed over here at the session today, is that in some cases systems are designed with a number of filter banks in series, and penetration is multiplicative. Therefore, when we have a maximum of 0.01% penetration through the first bank, we can multiply that times the second bank and the third and the fourth. By the time air passes through the third or fourth bank, the overall efficiency of the system may be seven or eight nines. This is very difficult to verify in the field, for certain, but that is, in effect, what is happening. When dealing with the public, this certainly needs to be brought to light. Even though there may be higher efficiency filters available, systems may be designed that provide higher efficiency by using basic HEPA filter construction.

FIRST: I would like to offer a couple of items of rebuttal to your presentation. The first one is that the user is concerned with the performance of the fabricated filter, not with the paper. The paper is the manufacturer's concern, not the user's concern. No matter how efficient the paper may be, if the filter is not put together as it should be, it is going to leak. I think it is important, in addition to having good paper, to have good construction, and this is why I made the proposal that I did. That is item number one. The second is this matter of efficiency of filters in series. When you have a monodisperse aerosol, such as 0.3 μm monodisperse DOP, each identical filter in the series can be depended upon to have equal efficiency, but when dealing with a polydisperse aerosol, there is differential efficiency by particle size. The effect of multiple filters in series is not the same efficiency with each stage, but a lesser efficiency for each stage because you are taking out the more easily filtered particles in the first stages and are left with the more difficultly filterable particles for the later stages. Therefore, equal efficiency for each stage in series is not quite correct.

FRANKLIN: We purchase our media. We are getting to the point where our supplier is trying to make better and better media for us, and we are getting more efficient media. We could probably convert without any change in anything to a minimum 99.99% HEPA filter, except that the pressure drop starts to rise, as Mr. Klocke advised. The pressure drop rises, and then there will be some rejects, either in our factory or by DOE, because the filters would exceed 1.0 in.w Therefore, there is a compromise that has to be made.

PORCO: In the same train of thought, we are talking about filters and we are keyed in on efficiency. Remember, for nuclear applications that is not the only design criterion. Filters are available to 99.999999% efficiency or higher, but do they meet the other design criteria? No. Right now, as far as I know, the only media that will meet all of the requirements, not just efficiency, but all of the requirements of the codes and standards, are those conforming to Section FC and/or Mil. Spec. F-51069. Is there anything out there that is more efficient and still meets all the design criteria, including strength?

FRANKLIN: I had an informal discussion with DOE about this and was advised that at present the measurements of what is leaving the facilities are very, very satisfactory using the present filters. Therefore, there is no administrative pressure to change the efficiency of the filter at this time. It may be advisable from a public awareness standpoint to say that the manufacturers have a standard of 99.97% and yet, they are meeting 99.99%. They always exceed the standard. That may be better from the public standpoint.

FIRST: The point I was trying to make was that the filters that pass through the filter test stations do meet all the requirements and do have efficiency in excess of 99.97%. So it is not a question of, will they meet it? They do, in fact, meet it. The other factor is that the filter manufacturers are selecting their best filters to go to the filter test stations. There is no question about it. Nevertheless, there are users who need less strict compliance to a very rigorous standard and, obviously, filters are not being discarded. There are other applications for them. So I do not think there is a real barrier in terms of availability, or even of cost. They have already met that proposed standard.

KLOCKE: I concur with both your statement and Ben's. We are building according to the current specifications and building good filters. We can essentially meet a 99.99% criterion with no impact at all today. Essentially all the filters are meeting the proposed requirement.

FIRST: The fact that DOE is not asking for a higher standard is not the only consideration. Sometimes we have to push DOE a little bit and sometimes we have to push NRC a little bit, to help them break through the red tape of their own organizations with which they struggle all the time.

SLAWSKI: We do argue internally about these things and one argument I heard about two weeks ago, from a person not an industrial hygienist, was that the respirable size of particles is larger than the size that is getting through. Therefore, we don't care about them. I am not sure I would put it that way, because it is a public issue. I do want to give the idea consideration within the department as well as with the manufacturers. If we are already doing it why not recognize it and take credit for it? It will not hurt us in any way.

WEIDLER: My question falls on what you have just said. What is more basic to me than the efficiency of the filter is what size particles we are concerned about dealing with. We are selecting 0.3 μm but is there a smaller particle that we need to deal with to have good efficiency? What is the basis of the 0.3 μm?

SLAWSKI: I do not know the history, Mel First or Werner Bergman may know. I know Werner Bergman has repeatedly stated to me that the most penetrating particle is smaller than 0.3 μm. Depending on who you are listening to there is a range roughly between 0.15 to about 0.18 μm.

FIRST: Yes, 0.3μm is historic. When Irving Langmuir was asked to advise the army on the size of the aerosol to use to test their gas mask filters, he did the same analysis that Werner Bergman showed yesterday with his computerized program and he advised the army that 0.3um was the minimum filterable size. He included impaction and diffusion, but did not include interception. Incidently, interception was an advance that was made by Wendell Anderson and his colleagues at the Naval Research Lab at a somewhat later date. Please keep in mind that the filters we have today are quite different than the filters that were manufactured in 1943, or thereabouts. The fact that today's filters have a different minimum filterable size is not at all surprising. More basically, you might ask, what is the significance of the minimum filterable size in terms of what we are looking for in a filter? We have no idea what the aerosol is going to be that the filter will encounter. We can not say precisely what we will need in that regard until an accident happens or some other event occurs that gives us a real life situation. Nevertheless, any rigorous test of the kind we are talking about, even though it may not use the minimum filterable particle size, assures us that we have a high quality product. The test gives us a "figure of merit" even when it does not give us a precise efficiency number for what the filter will do in normal service.

WEBER: I would like to focus on some comments that Steve Klocke and Ben Franklin made by combining them. The issue is the clean pressure drop of a filter. This reflects some comments that Dr. Bergman made yesterday. Clean pressure drop is limited in most cases to 1.0 in.w. I think that number is held too affectionately because face velocity is by and large the big parameter with respect to dirt loading and I think the intent behind 1.0 in.w. is to assure the maximum useable life of a filter that will be disposed of in the end. Consider also the physical limitations of the filter, whatever they may be. To me, the important point is, what is the dirt capacity of the filter? For a given filter medium, that is mostly a function of accessible surface area. One could conceive of a fiber filter, or a metal filter, which has a low face velocity, but a somewhat higher pressure drop, and lasts longer. When Dr. Bergman said that a filter made of metal fibers of 1μm would fail, I think what he meant to say was that it would not meet the 1 in. w. pressure drop requirement. That is true. In a prior paper by Dr. Bergman, he said that the metal medium had twice the unit pressure drop of comparable efficiency glass media. I think the state of the art has improved considerably since that time. The upshot is, if you split the difference between 1.0 in.w. and twice that much, you may be getting enough additional area that the filter will last longer before it reaches the fan's limit. In the case of metal media, you would be cleaning the filter. My point is a generic one, I think that the 1 in.w. is held too affectionately and that some more consideration should be given to accessible filter area since plugging of a HEPA filter has been shown in these conferences to be principally a surface phenomenon. If that is agreed to, then there could be some other test which could be used to validate the dirt capacity of the filter, such as the ASHRAE 52 test.

FRANKLIN: As a filter manufacturer, we try to meet what the industry and our clients require. This change in the FC code allows 1.3 in.w. for a 1,500 CFM, 24 in. by 24 in. separator filter. We have had no problem with building higher pressure drop filters. It depends on the user's fans, system, et cetera.

ROWAN: We get into arguments sometimes on setting requirements. The general argument I hear against setting requirements is that, when you do not really have to meet them, you lose flexibility in design. For instance, later on something may come up that means you have to have higher temperature resistance, or something like that, as a first priority, but once a specific penetration requirement gets into the code it is pretty hard to get around it. Quite often, you can meet other requirements by relaxing the pressure drop requirement. It is one of the disadvantages of rigid

requirements. We have seen cases where they set requirements way, way too high for certain items simply because they could meet it but then they run into trouble later.

PORCO: That is a good point. Those of you who are close to the working groups in the CONAGT committee know that there is a conscious effort to move towards performance-based standards and code sections rather than equipment-based standards. In the future, I hope you will start to see more flexibility because of that. This question was from Laurie Todd, Farr Company. What is the quantity of filters required for testing? FC reads eleven, it is in table FC 5100-1. Are all eleven required?

HAYES: Yes, all eleven are required.

PORCO: The next question is also from Laurie Todd. Since the QPL is technically obsolete and a certificate of conformance (C of C) is required per AG-1, section FC, will all manufacturers have to submit filters for test to obtain C of Cs now? In other words, if the QPL is gone, doesn't the C of C time frame of five years begin now?

PORCO: The answer relates back to the QA issue. The code requires adherence. If the individual manufacturer presents proof of compliance, and it is acceptable within their QA program, and auditable, then it would be acceptable. If they have previous tests that are acceptable, *ie.*, they have positive proof, all of the necessary calibrations, necessary certifications, etc. in a format required by NQA-1, then I would say from that point on, the data are valid through the five year period and should be acceptable.

FIRST: We heard John Dyment speak about the British and the European standards and that they do their testing somewhat differently than we do. There is no indication, nevertheless, that the quality and performance of their filters is any different than ours. I believe they are quite the same. If we try to prove comparability, as we have in the past, by spending uncountable dollars trying to reconcile the various tests that use different particle sizes, different particle size distributions, different particle shapes, what we find is that there is not a convertible number that we can use with reliability. Rather than getting into that quest again, I would suggest to the committee to open the code and make it more acceptable from the standpoint of performance rather than hardware; so that there can be alternatives. In other words, when filters meet the European standard or the British standard, or any other standard that we recognize as being comparable to ours, we would accept that test as comparable performance. That would make things a lot better for manufacturers who want to sell from country to country. They could simply say, whichever one of these valid standards or codes that you have to conform to, they are all the same.

PORCO: That is an excellent point. The ASME is moving towards globalization. I think the leader in global standards is the QA Standard ISO 9000. For performance standards, I am sure we are somewhat restricted within the ASME code. Ray, would you like to comment on how easy it would be to do it?

WEIDLER: I don't know how you would recognize that concept through ASME. To me, this is a purchasing issue. If you could have a truly international standard, i.e., twelve, fifteen countries could agree on one standard and have it be governed by one body, then we probably could do it. But we can't say we are going to do it through ASME; it would be desirable but difficult because we have not done that at this point.

FRANKLIN: I have a question for Mr. Slawski. We have a QPL on a filter with exterior fire retardant plywood, as required. If we wanted to switch to marine fire retardant plywood, would we have to get a new QPL, or would DOE accept a proposal for a QPL filter revised to use marine plywood?

SLAWSKI: I don't know the answer to that. I think I would have to discuss it with the manufacturers, people like Rich Porco, and people from Aberdeen. Having said that, I will now say that, intuitively, it does not sound like that is a degradation. But I think you would still want some agreement among more than one party because it would affect other manufacturers.

DERDERIAN: A lot of the fire protection specifications within the code have been placed there in past years by the fire protection community to lessen the probability of fires. Basically, they are intended to reduce combustibility, or reduce the level of susceptibility to fire. Some of the provisions are beginning to change in the code. I am wondering if prescriptiveness is going to become the design basis. Is it going to be related to a design basis, as you seem to be indicating, or is it some other situation?

PORCO: I am not sure we are changing the requirement. In FC, there are two very tough requirements; UL 586, for the filter, and a heated air test. You cannot pass the heated air test if you add additional volatiles. I am no longer in filter manufacturing, but one of the toughest things for filter manufacturers to do is to manufacture a very rugged filter and still limit the amount of volatiles in the binder and adhesive used in the filter. What I am saying about performance-based requirements is that, in addition, you have application specific requirements and you must add them to the requirements of FC.

DERDERIAN: Is that specifically stated within the code, or is it something that is implied?

PORCO: That is something I went through this morning, it is stated in Section I, but I am not sure it is as clear as it should be. I think that is the reason why ISNATT, for instance, is looking at design guides to help the user apply the codes and standards.

FRETTHOLD: To expand on Laurie Todd's question, you need to define the number of filters that are required for each of the QPL tests. It is a bit vague right now. It is something we need to work on in the committee to permit people to qualify their filters.

HAYES: I agree. I think the concern is the call for eleven filters of each size. Is that the issue? That is something we will take under advisement with the working group.

FRETTHOLD: The thought was to get it into the record of the meeting, that would serve for people who want to qualify filters.

PORCO: Since this is a living code, the way to find problems and improve the document is through implementation and use. My experience with AG-1 is that it is being applied in the far east, in Korea and in China. All of a sudden, the things we put in the codes and thought were very clear are being read by Asians. They take a very literal interpretation of the code. So it is important that we make sure that all requirements in the codes are very clear and are not subject to different interpretations. I think that is a very difficult task for those working on the codes. We welcome all suggestions, recommendations, and constructive criticism. We will work on all problems to make sure

that they do meet the needs of industry. If there are no other questions, I will ask Jack Hayes to summarize.

HAYES: As the subgroup chairman for section FC, I would like once again to emphasize to all those present that, it is our intention to upgrade the code section and that we have no hidden agenda. It is not our intention to perpetuate the existing designs. If you have contributions you can make in terms of where we should be going, I encourage you to give your name to me, to Ray Weidler, or to Rich Porco. We solicit your participation. We need your participation. Based upon your participation, this will be either a good or a bad code section. In summary for this morning, we heard first from Ray Weidler who discussed the first twenty years of the ASME committee on nuclear air and gas treatment, as prepared by of one of the founding members, Jack Jacox. We also had a discussion of the progression of the European standard for the HEPA filter. It is under development and will be completed in June, 1997. There were additional discussions on HEPA filters from the US perspective. The weaknesses associated with particular designs were cited and where we should be going, both with respect to the design and with respect to the standards, was presented by Dr. Ricketts. Finally, we had a panel discussion on revisions to code Section FC of the AG-1 code. Issues raised during this panel discussion included the frequency of testing, whether it should be more frequent, the acceptance of failures of certain of the qualifying filters, and the need, or the lack of need, to have 100% of units passing. We also discussed whether there is a need to improve the acceptance criteria for penetration by moving up to 99.99% from the 99.97% required by the present standard. The comment was tempered by the fact that raising qualification standards may close off a particular design to some needed applications.