SESSION 13

PANEL SESSION: CARBON TESTING

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Moderator: J. L. Kovach

Panel
Members: J. R. Pearson
J. J. Hayes
C. F. Gill

OPENING COMMENTS OF PANEL MODERATOR KOVACH

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PANEL DISCUSSION

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KOVACH: Panel members are Dr. Charles Gill, US NRC, Region III; Jack Hayes, US NRC, Headquarters; John Pearson, NCS Corporation

RESPONSE OF NRC REGION III TO PERCEIVED LACK OF FILTER TESTING EXPERTISE CONCERNS

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ABSTRACT

During the 21st (1990) DOE/NRC Nuclear Air Cleaning Conference, several papers, presentations and panel discussions raised concerns regarding the perceived lack of Nuclear Air Treatment System (NATS) filter testing expertise allegedly exhibited by some NRC licensees and inspectors. The NRC Region III responded to these concerns by significantly improving the filter testing training course and ensuring that appropriate Regional inspectors, their supervision and management attended the course. The extensive training program, improved inspections and resultant licensee corrective actions have significantly improved filter testing expertise and the quality of Region III licensee filter testing programs.

I. INTRODUCTION

Each year potentially generic technical deficiencies of significance to the nuclear industry are identified in technical journal articles and conference and professional society meeting papers. Once the NRC becomes aware of these reported deficiencies, the staff reviews each item and responds as deemed appropriate by management. The NRC staff's response mechanisms include: Generic Letters, Bulletins, Information Notices, Standard Review Plan (NUREG-0800) revisions, docketed Final Safety Analysis Report (FSAR) questions, special studies, special (reactive) inspections, and inspection and training program revisions. At the 19th (1986) Nuclear Air Cleaning Conference, a paper was presented regarding the reactive inspection response of the NRC Region III to potential technical deficiencies identified in the 17th (1982) and 18th (1984) Nuclear Air Cleaning Conference papers and proceedings.[1]

This paper deals with the response of the NRC Region III to potential technical deficiencies identified in recent Nuclear Air Cleaning Conference papers and proceedings. Specifically, during the 21st (1990) DOE/NRC Nuclear Air Cleaning Conference, several papers and panel discussions raised concerns regarding the perceived lack of Nuclear Air Treatment System (NATS) filter testing expertise allegedly exhibited by some NRC licensees and inspectors. These concerns and the status of the Regional response are discussed below.

The NATS filter testing implementation aspects relevant to this discussion are the in-place penetration tests [dioctyl phthalate (DOP) challenges to high-efficiency particulate air (HEPA) filters and refrigerant tracer gas ("Freon") challenges to impregnated activated charcoal (carbon) adsorbers] and laboratory penetration tests (radioactive methyl iodide challenges to carbon adsorber samples). Nuclear Power Plant (NPP) licensees are required by their plant-specific technical specifications (TS), periodically and under certain plant conditions, to test specified NATS filters to required acceptance criteria (testing protocols and penetration limits). The bases for the TS requirements are nominally Regulatory Guides (RG) [e.g., Revision 2 of RG 1.52[2] and Revision 1 of RG 1.140[3]] or industry consensus standards [e.g., ANSI/ASME N510-1989[4] and ANSI/ASTM D3803-1989[5]]. Licensee NATS TS are also voluntarily revised based on guidance presented in NRC Generic Letters (GL) [e.g., GL No. 83-13[6]], Information Notices (IN) [e.g., IN 86-76[7] and 87-32[8]], and NRC contractor reports [e.g., EGG-CS-7653[9], and NUREG/CR-4960[10]].

II. CONCERNS

During the 21st (1990) DOE/NRC Nuclear Air Cleaning Conference (NACC), several papers and panel discussions expressed concerns that apparently some NPP licensees and NRC inspectors lacked a significant depth of NATS filter testing expertise. The concerns expressed by four individuals are discussed in this paper. These specific expressions of concern were chosen because they are representative of those discussed during the conference and were presented by reputable NATS filter testing experts.

Fellow panel member and NRC employee, Jack Hayes, gave an excellent presentation entitled, "Changes in Adsorber Testing as a Result of NRC Generic Information," at the 21st NACC[11]. His paper was based on survey results received from a questionnaire he sent to NRC NPP licensees. The questionnaire dealt almost exclusively with laboratory methyl iodide testing protocols and penetration acceptance criteria for carbon adsorber samples. Among the NRC generic information documents referenced in the questionnaire were IN 87-32[8], "Deficiencies in the Testing of Nuclear-grade Activated Charcoal," and the companion NRC contractor report, EGG-CS-7653[9]. The results of the questionnaire study revealed that very few licensees had implemented the generic information and few were contemplating utilizing the information. The study also showed that the limited implementation was typically incomplete or incorrect.

During the 21st NACC Panel Session on ANSI/ASME N510 Testing, Louis Kovach had the following comments regarding the filter testing expertise of some NRC inspectors[12]: "Maybe we need to have better training given at the NRC Regions to bring all the inspectors up to some minimum understanding of what it is they are trying to enforce. It is my understanding that some training has been offered but it does not seem to be enough to assure good

quality NRC personnel at the sites in regard to indepth understanding of air cleaning issues."

Jack Jacox and Ray Weidler, also during the 21st NACC Panel Session on ANSI/ASME N510 Testing, noted a perceived lack of filter testing expertise among the NPP licensees[13]. It was stated that there were fewer and fewer NPP licensees willing to pay for expertise in HVAC systems, including filter testing.

Based on filter testing program weaknesses identified by NRC Region III inspectors, the above perceived lack of expertise was apparently a significant contributor to the general failure of the NPP industry to utilize the NRC generic information documents on HVAC systems and NATS filter testing. This failure was identified by the questionnaire survey conducted by Jack Hayes.[11]

This general lack of expertise among NPP licensees, as well as initially for some NRC inspectors, was readily apparent with regard to IN 87-32, "Deficiencies in the Testing of Nuclear-grade Activated Charcoal," and the companion NRC Contractor report, EGG-CS-7653. Many NPP licensees, as well as NRC inspectors, initially assumed that as long as the licensees used one of the two laboratories that met the acceptance criteria for methyl iodide penetration testing using the EG&G protocol, they had fully followed the Information Notice recommendations. Later inspections in Region III corrected these misconceptions. However, licensee misconceptions are not limited to methyl iodide testing. Inspections in Region III have also identified NPP licensee misconceptions regarding in-place NATS filter testing programs.

III. NRC REGION III RESPONSE TO CONCERNS

The NRC Region III realized that the above concerns expressed at the 21st NACC had some validity and proceeded to improve the filter testing training program for appropriate region-based inspectors. In the past two years, NRC Region III has expanded the one-day orientation filter testing course for NRC inspectors to a two-day comprehensive theory and practical factors course and completed the training for nearly all materials and reactor radiation protection inspectors, their supervisors and managers. It is now a formal course sponsored by the NRC Technical Training Center and available to all NRC personnel, including resident inspectors and NRR technical reviewers.

The inspectors' critiques of the course showed that it achieved its goal of providing a good basic understanding of filter testing sufficient to inspect this aspect of their licensees' programs. Because of this improved NRC training program and the resultant improved inspections, Louis Kovach's comments of two years ago about the quality of NRC inspectors in the area of filter testing is certainly no longer valid for Region III radiation protection inspectors.

Now that our region-based inspectors are better prepared to review licensees' filter testing programs, they routinely assess the technical expertise of NPP personnel who are responsible for ensuring that the filter testing program is correctly implemented. Section IV below discusses an effective program review technique that is available for use by NRC inspectors to ascertain if our licensees have any basic filter testing program requirement misconceptions.

IV. EFFECTIVE INSPECTION TECHNIQUE

The NRC core inspection procedures will assure that licensees have complied with their plant specific NATS filter testing TS requirements. Although these procedures will assure regulatory compliance, licensee misconceptions about filter testing requirements and regulatory guidance may still result in safety concerns.

Therefore, in addition to the line item core inspection procedure checklist for filter testing program implementation review, an overview technique may be used to ascertain if licensees have any basic filter testing program requirement misconceptions. The completion of the following six-item comparison list for what should be compatible aspects of the program is one possible method for identifying underlying safety concerns.

- Test Results
- TS Requirements
- Procedural Requirements
- Purchase Order Criteria
- Design Basis Removal (or Efficiency) Credit
- NRC Regulatory Guidance

If there are apparent discrepancies in the filter testing acceptance criteria stated in the above items, a potential exists for safety concerns that need resolution.

V. CONCLUSION

The NRC Region III responded to concerns expressed two years ago at the 21st NACC regarding perceived lack of filter testing expertise by some NPP licensees and NRC inspectors. The extensive NRC training program, improved inspections and resultant licensee corrective actions have significantly improved filter testing expertise and the quality of our NPP licensees' program implementation.

VI. REFERENCES

1. Gill, C. F., "Reactive Inspection Response of NRC Region III to Potential Technical Deficiencies Identified in Recent Nuclear Air Cleaning Conference Papers," Proceedings of the 19th DOE/NRC Nuclear Air Cleaning Conference, NUREG/CP-0086, CONF-860820, Volume 1, Page 527 (August 1986).

2. U.S. Nuclear Regulatory Commission, "Design, Testing, and Maintenance Criteria for Post Accident Engineering-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.52, Revision 2 (1978).

3. U.S. Nuclear Regulatory Commission, "Design, Testing, and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," Regulatory Guide 1.140, Revision 1 (1979).

4. American National Standard, "Testing of Nuclear Air-Cleaning Systems," ANSI/ASME N510-1989, The American Society of Mechanical Engineers (1989).

5. American National Standard, "Standard Test Method for Nuclear-Grade Activated Carbon," ANSI/ASTM D3803-1989, American Society for Testing and Materials (1990).

6. U.S. Nuclear Regulatory Commission (NRC) Generic Letter No. 83-13,"Clarification of Surveillance Requirements for HEPA Filters and Charcoal Adsorber Units in Standard Technical Specifications on ESF Cleanup Systems," issued to all applicants for operating licenses and holders of construction permits for nuclear power reactors on March 2, 1983.

7. U.S. Nuclear Regulatory Commission, "Problems Noted in Control Room Emergency Ventilation Systems," Information Notice No. 86-76 (1986).

8. U.S. Nuclear Regulatory Commission, "Deficiencies in the Testing of Nuclear-Grade Activated Charcoal," Information Notice No. 87-32 (1987).

9. Scarpellino, C. D. and Sill, C. W., "Final Technical Evaluation Report for the NRC/INEL Activated Carbon Testing Program," EGG-CS-7653 (1987).

10. Driscoll, J. W., "Control Room Habitability Survey of Licensed Commercial Nuclear Power Generating Stations," NUREG/CR-4960, ANL-87-22 (1987).

11. Hayes, John J., "Changes in Adsorber Testing as a Result of NRC Generic Information," Proceedings of the 21st DOE/NRC Nuclear Air Cleaning Conference, NUREG/CP-0116, CONF-900813, Volume 2, Page 607 (August 1990).

12. Kovach, J. L., "Panel Discussion: How to Use N510 Testing Methods and Acceptance Criteria for Air Treatment Systems Not Constructed According to N509," Proceedings of the 21st DOE/NRC Nuclear Air Cleaning Conference, NUREG/CP-0116, CONF-900813, Volume 1, Page 333 (August 1990).

13. Weidler, R. R. and J. W. Jacox, "Panel Discussion: How to Use

N510 Testing Methods and Acceptance Criteria for Air Treatment Systems Not Constructed According to N509," Proceedings of the 21st DOE/NRC Nuclear Air Cleaning Conference, NUREG/CP-0116, CONF-900813, Volume 1, Pages 338 and 339 (August 1990).

DISCUSSION

DUBOIS: What percent of your resident inspectors get this special training, is it only the Region III and headquarters based inspectors?

GILL: Only the health physics staff at the Region III office have had the training at this time. A concerted effort has been made to make sure that all the health physics inspectors have had this training. The deputy director of our division is on the regional training council and he has been spearheading the effort to get people to take this course. He intends to have as many of our region's inspectors take this course as he can and to encourage other regional managers to support this effort. I hope this initiative becomes very widespread within the NRC.

METHYL IODIDE TESTS ON USED ADSORBENTS

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Background

This Paper discusses the history of events leading to the current problems in radioiodine test conditions. These radioiodine tests are performed on the adsorbent media from both safety and non-safety related Nuclear Air Treatment Systems (NATS).

During the development of laboratory tests for radioactive methyl iodide removal efficiency of adsorbents at ORNL and later by the ASTM D28 Committee in the mid 1960's, three typical test parameter ranges were evaluated. These test conditions were selected to challenge the adsorbent at the various temperatures and humidity values which may occur in operation and presumed accident conditions of the nuclear power plant (NPP). The then selected temperature - humidity pairs were:

30°C	95% RH
80°C	70% RH
130°C	95% RH (DBA environment in containment)

which were incorporated into the original issue of the standard test procedure ASTM D3803-1979.

The early laboratory test assemblies used to perform these tests, had great difficulty in maintaining 95% RH (steam-air mixture) at 130°C due to test control problems. The test adsorbent samples were often flooded (supersaturated with water) during this test resulting in widely scattered radioactive methyl iodide removal efficiencies. On the basis of the initial preponderance of low efficiency results obtained at 130°C and 95% RH there may have been an initial presumption that the high temperature/high RH test was the "most severe" and, therefore, most conservative in evaluating the performance of the adsorbent. Based on this presumption, the 130°C, 95% RH test was prescribed by the NRC even for Main Control Room NATS methyl iodide removal efficiency tests which in an accident scenario would never be exposed to temperatures and relative humidities in this range.

Over the years as the test precision improved, it became clear that the performance of the adsorbent is, in fact, improved at high temperature and low RH and that the most conservative test is the low temperature-high RH (i.e. 30°C, 95% RH) test. This conclusion has been published in the open literature(1) and its findings have been accepted by both US and International experts in the field of adsorbent testing. ASTM D-3803 was revised in 1989 to reflect the more precise test protocol and conservative test parameters based on USNRC funded research at Idaho National Engineering Laboratory (INEL).(2)

When preparing specifications and purchase orders for the testing of used adsorbents, NPP personnel are not sure which ASTM D3803 (or ANSI/ASME N509 and N510) issue to use; in some cases they specify performance of multiple tests on the same sample to assure both a technical correctness based on current test procedures and a technical specification requirement based on outdated test protocols required by current issue of Reg. Guide 1.52. To further complicate matters, some NRC regions have requested NPP personnel to modify test parameters on a plant by plant basis.

Problem Statement and Discussion

Currently there are still numerous plant technical specifications for NATS which reference outdated test protocols for the surveillance testing of the radioactive methyl iodide performance of the adsorbents.

Additionally, it has been found that high temperature (≈130°C) pre-equilibration* of used adsorbent, in fact regenerates the carbon by stripping off the poisoning contaminants and results in a "false" high methyl iodide removal efficiency, while the same adsorbent shows much lower performance under low temperature test conditions.(4)

As an example, an adsorbent removed from a Nuclear Power Plant (NPP) Main Control Room NATS showed the following efficiencies when tested in the laboratory under the various test conditions.(3)

Temperature of Test	RH %	$CH_3{}^{131}I$ Efficiency % Sample #1	Sample #2
30°C	95	33.79	37.37
80°C	95	60.45	--
130°C	95	99.87	98.34

These test data, which are typical, (4) clearly show that the most conservative test for testing methyl iodide removal efficiency is the low temperature, (i.e. 30°C) test.

The performance of the test at 95% RH requires a very precise control of the relative humidity by the laboratory apparatus controls. The test series performed at INEL(2) concluded that the original ASTM D3803-79 temperature and relative humidity tolerances were too wide. As an example, the originally permitted ± 2% RH tolerance could result in methyl iodide penetrations (100 - efficiency) as follows (2):

93% RH	0.29 ± 0.07% penetration
95% RH	0.56 ± 0.11% penetration
96% RH	1.12 ± 0.2% penetration
97% RH	4.85 ± 1.2% penetration

Based on the round robin tests performed by the ASME CONAGT(5) and INEL(2), sensitivity data were obtained which permitted the revision of ASTM D3803 in the 1989 version for the 30°C, 95(+1, -2)% RH test protocol which the ASTM Committee considered suitably conservative test conditions. While the test parameter tolerance limits for test conditions other than the 30°C 95% RH test were not established, it was recommended by the ASTM D28 Committee that if the test condition tolerances in ASTM D3803-1989 for the 30°C, 95% RH test were followed, tests at the 80°C, 95% RH, 80°C, 70% RH, etc. conditions could also be performed in a reproducible manner. (This recommendation has been validated in the tests being performed by at least one test laboratory).(7)

The INEL study also indicated that a significantly more conservative test result is obtained at 30°C (for the used carbons tested) if the sample is first pre-equilibrated for 16 to 18 hours at 95% relative humidity (at 30°C) compared to unpre-equilibrated test conditions. While such high relative humidity may not always exist in NATS without humidity control, there were observations that 95% RH had been experienced. Therefore, for systems without qualified humidity control, the performance of the methyl iodide removal test at a pre-equilibrated water loading equivalent to 95% RH is justified.

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* Pre-equilibration is the 16-hour exposure of the adsorbent sample to a specified relative humidity air prior to the introduction of the radioactive methyl iodide tracer.

Where properly designed humidity control exists, which prevents the water loading of the absorbent above 70% RH, corresponding equilibrium conditions can be justified such that the used carbon test can be performed at 70% RH. It is important to note here that systems which are exposed to higher than 70% RH in standby mode would dry out to a 70% RH equilibrium water condition only after many hours of air flow at the <70% RH air stream. Therefore, the provision of normally de-energized heaters, without prevention of higher than 70% RH equilibrium water loading will not provide assurance of instantaneous performance corresponding to a 70% test condition. As a matter of fact, if the carbon in the standby mode is loaded to a higher than 70% RH equivalent condition, the desorption of the water from the front of the bed will decrease the temperature and increase the relative humidity in the downstream side of the carbon bed.

It is important to establish iodine adsorbent test conditions based on realistic accident scenarios so that the test results obtained can be better correlated to the required dose analysis, while keeping in mind that there is no direct correlation between a test performed under arbitrary selected conservative conditions and the actual performance of a system during a particular accident. The test, in fact, is a benchmark performance test for the establishment of the appropriate dose reduction credit.

New (unused) carbon efficiency requirements currently specified in ANSI/ASME N509-1989 and in Section FF of the ANSI/ASME AG-1 Code for a 2.0 inch bed depth are 3% maximum penetration at 30°C and 95% RH (Commercial carbons are available which provide < 1.0% penetration under the above conditions). Significant aging or weathering of the carbon during use in NATS will result in a higher penetration than that for the new carbon. The aging and weathering of the carbon cannot be accurately predicted because it depends on type and frequency of exposure to adsorbable chemical compounds (painting, cleaning, welding, etc.) during its life. But in all cases the methyl iodide removal efficiency will be less than that of the new carbon. Therefore, if the maximum permissible penetration for new carbon is 3.0% maximum, then the in-service test result has to be acceptable at some higher penetration. This acceptance limit has to be based on the specific realistic dose assessment for the particular NATS application.

Conclusions and Recommendations

The current widespread references to USNRC Regulatory Guide 1.52 Rev. 2 are no longer valid, because the Guide and its revisions were written based on outdated test methods and test conditions. The change from old test methods to the pre-equilibrated 30°C, 95% RH or other pre-equilibration temperature and humidity test results also needs to be reflected in changes of the various NPP Technical Specification acceptance limits which are based on Table 2 of the outdated Regulatory Guide 1.52 Rev. 2.(6) The best solution would be the timely issue of the long promised Rev. 3 of Reg. Guide 1.52, which would recognize the existing air cleaning technology knowledge and industry standards. In the absence of a technically sound Reg. Guide 1.52 the burden of justifying individual plant related changes on acceptable methyl iodide penetration will result in further confusion at a considerable expense.

Therefore, an industry-wide revised Standard Technical Specification needs to be drafted in conjunction with the issue of USNRC Reg. Guide 1.52 Rev. 3.

References

1. Deuber, H & Gerlach, K — "Parametric Investigations on the Retention of Methyl Iodide by a KI Impregnated Activated Carbon", (KfK Karlsruhe) Reports KfK 3594 (1983) KfK 3594 (1984) and Nuclear Safety Vol 26. No. 2 pp 157-169 (1985).

2. Scarpellino, C.D. et al. — "Technical Evaluation Report of Testing Procedures for Activated Carbon Adsorbers in Ventillation Filter Assemblies in Nuclear Power Plants", EG&G Idaho Report EGG-CS-7131 (1985) and Final Technical Evaluation Report for NRC/INEL Activated Carbon Testing Program EGG-CS-7653 (1987).

3. Kovach, J. L. — Notes on Radioiodine Adsorption. NUCON Report 265 (1987)

4. Freeman, W. P. — Radioiodine Testing of Used Nuclear Grade Activated Carbon: Penetration Results from Samples Tested with and without Moisture Equilibration According to a Draft Revision of ASTM D3803 USNRC Report NUREG/CP-0098 pp 997-1002 (1988).

5. First, M. W. — Tabulation of ASME CONAGT Round Robin Test Results (1983).

6. Dick, R. L. — Letter dated 30 September 1991 to Dr. Thomas Murley, USNRC.

7. Freeman, W. P. — Personal communication. 1990.

DISCUSSION

OLSON: I agree with everything you said and I appreciate your support for plant engineers that have a difficult time. Something I want to mention that was not brought out here but goes back to Mr. Gill's presentation, is bypass leakage under DOP and Freon testing. I believe the material you gave for methyl iodide is all published in standards and Tech Specs. Also there were some changes related to bypass leakage. Would you comment on this, please?

HAYES: There was a generic letter, numbered 83-13, (GL 83-13) issued in 1983, after the TMI accident. It attempted to make sure that everyone had ESF filter Tech. Specs. and to ensure that the TS contained the same standard requirements. Unfortunately, that generic letter included an error in the footnote in terms of the allowable penetration for the in-place DOP and Freon tests and for the laboratory testing criteria for charcoal. The correct value for the in-place test should be .05% penetration for both Freon and DOP. We have, in the past allowed some leeway, up to, 1%, for systems that have a built-in bypass. By built-in bypass, I am talking about systems where there are diverting dampers that, in normal operations, allow air flow to bypass the filter units. In order to initiate filter unit operation, you have to close some dampers and direct the flow through the filter units. In the past, the NRC has recognize the problem associated with by-pass leakage for those types of dampers. However, a point that licensees have missed is that they have not included the 1% by-pass in their accident calculations. You have to make sure that the two go hand-in-hand. But you are right, there has been a problem perpetuated by that generic letter.

OLSON: One other thing. Not to harp on revisions to Reg. Guide 1.52, but are the right people involved with the preparation of standard Tech. Specs. instead of just referencing Reg. Guide 1.52?

HAYES: I look at the lack of a recent revision of Reg. Guide 1.52 to be somewhat of a cop-out on the part of industry. There is nothing to prevent industry from adapting either a new ANSI standard or a new ASTM standard. However, even if a revision to RG 1.52 was to be issued, there is nothing that requires licensees to implement that particular revision of the Reg. Guide.

OLSON: I agree. I didn't mean to suggest that a new Reg. Guide 1.52 would take care of all the problems. We have mentioned that a number of times at this meeting. I agree, a revision of Reg. Guide 1.52 is not going to resolve all the issues, but I hope that in the future by taking a little more careful look at our Tech. Specs., and additions to Tech. Specs., we might be able to resolve some of these problems upfront.

KUMAR: The relative humidity that the system would see should be the governing testing criterion rather than the presence or absence of heaters in the system.

HAYES: If we were to establish laboratory test conditions based upon the anticipated relative humidity that the system would see in the event of an accident, we would have more test conditions then we presently have. Therefore, the NRC addresses two situations, high relative humidity, i.e., >70% RH and low relative humidity, i.e., <70%. To address these two situations, the charcoal testing industry developed two test conditions, 70% RH and 95% RH. The NRC has implemented the 70% test condition for systems with heaters and 95% for systems without heaters. There are situations where relative humidity may be controlled such that the laboratory test could be conducted at 70% RH even though no heaters are present. A possible example would be the control room. However, with or without relative humidity control, one should ensure that condensation is not occurring in the adsorber unit when it is idle and that the air to be treated is always at a low relative humidity.

BURWINKEL: Something left out this morning is, when you test according to ASTM D3803-89, and the penetrations are calculated per your credited allowance, should your test bed depth be the actual installed bed, or should it be a standard 2"?

HAYES: It should be based upon your actual bed depth. Let me bring up a situation that is occurring now. We have one licensee in the enviable situation where they have a 4" bed but they only need a 30% credit for the accident evaluation. Would you have them test that type of charcoal with an acceptance criterion for each 2" increment of 50%? We have presently taken the position that 50% charcoal is unacceptable. Charcoal should perform much better than that. However, the matter is still under discussion as to whether this licensee should be allowed to test the 4" bed at an acceptance criterion associated with 30%. Usually, bed depth of test samples should be the same as the actual bed depth. However, the NRC may limit the sample depth if it perceives that allowance of the bed depth to be sampled and tested would be a laboratory test of charcoal such that the acceptance criteria would call into question the worthiness of the charcoal to remove radioiodine. It is one of the reasons why we may not allow degradation to "as low as possible." For example, testing a four inch bed tested to 10% allowable penetration would only show a removal efficiency of approximately 68% per two inch bed. Charcoal which performs at this level is unsuitable in a nuclear installation. So there may be a level below which the NRC may not allow charcoal acceptance criteria to go.

BURWINKEL: What I have heard is that there is some lower limit that ought to be imposed on carbon performance.

HAYES: I think it is realistic to believe that charcoal should not last forever. To my recollection, there is a part of Reg. Guide 1.52 or N-510 that said, after 5 or 6 years you replace the charcoal.

BURWINKEL: The other thing I wanted to point out is that I continually hear that we need to test to ASTM D-3803-89, and I agree with that. But that is a 95% relative humidity test on a 2" bed. We need to make sure that people understand that the test we are looking for is under D3803-89 conditions at the specified relative humidity and test bed depth.

HAYES: If you read my paper, I think it will be clear. That is, not everyone will be testing at 95% R.H.

PEARSON: What would you tell a client that was considering changing to the 1989 version of ASTM who had a technical specification calling for 1%.

HAYES: A 2" bed and 95% R.H.?

PEARSON: Yes, with or without heaters. It really doesn't matter. He is in a position that he can't win. He would like to do it, but how? Is the Commission willing to relax his technical specification.

HAYES: We had at least one incident where we had relaxed the safety factor associated with the adsorber. I think that was probably the first one we went through in terms of re-licensing. My personal opinion (and it is not based upon test data) is that I don't envision licensee's having much of a problem meeting 99% doing the test with heaters at 70% R.H., if they have good charcoal to begin with. The people who really know whether this is correct are you and Kovach; you have that information. As I pointed out on the last viewgraph, what is important to me is, what is the charcoal capable of retaining if it really is at 95%? That is the real issue. I think you would have a difficult time meeting the 1%. I would be skeptical that you could meet it, to be honest with you. The unfortunate thing is, I don't believe we have enough data to say that this is the true capability of the charcoal.

PEARSON: How does a facility with a 99% T.S. change to ASTM D3803-1989?

HAYES: The problem licensee's face with changing to the ASTM D3803-1989 method is, can they meet their T.S. value with the new method? My opinion is, they probably can if they have heaters. If they don't have heaters, then I believe that it may be difficult for licensees to meet their acceptance criteria. The question then becomes, does the NRC safety factor change or does the adsorber efficiency credited for radioiodine removal change? The NRC prefers the latter. If such changes to adsorber efficiency do change, then it is necessary to reanalyze the doses

associated with accident analyses. As long as GDC 19, Part 100 doses, and SRP doses are met, credit for lower efficiencies may be granted. It would be useful if, at the next Air Cleaning Conference, you and Pete Freeman could present a paper giving the results of a comparison in testing results using the D-3803-1989 and other test methods.

PEARSON: I agree with John Peterson's comments. If utilities change to the 30/95 or 30/70 test, 99% efficiency may be an unrealistic requirement.

GUEST: I have been listening to this discussion about regulations and rules concerning the many combinations of ways to do the tests. And there are all kinds of arguments on bed depth, humidity, and so on. But I have not, as yet, heard one single word discussing the real problem, this is, how do you get a sample out of the filter that represents all of the material that is in there? You can discuss all the ways to conduct correct carbon tests, but if your sample doesn't represent what is in the filter, the information you generate by testing it is absolutely useless.

HAYES: I will be honest, I didn't realize that sampling was such a big problem.

KOVACH: After a number of presentations, the problem of representativeness is thrown back to the designer. The correct standards and AG-1 code require that whatever sampling methods are used must be verified to give samples representative of the actual conditions. I agree with you, that the current sampling canisters and some trays, which have a few sample canisters, are, in a few cases, absolute abominations. We have seen standard trays interspaced with so-called test canister trays, but the test canister tray pressure drop, at the same flow, was more than twice as high as the standard tray. Obviously, flow is not going to be the same through all of these units. Unfortunately, AG-1 is designed for only two reactors that we know about, both of which will be built everywhere else except in the United States in the future. There is presently no requirement in any of the standards to make sure that sampling now being done according to some of the old ASTM and ASME procedures is correct. As a matter of fact, one of the ASME standards, N-510 or N-509, shows that the testing tray method that is currently endorsed by the Reg. Guide and by a number of Tech. Specs. absolutely won't work. Yes, we have a very big problem to assure that samples are actually representative.

GUEST: We have, as you know, previously presented data at these conferences where we have taken samples from different places in the filter, and came up with different results. That is why we have gone to an in-situ test. Not because of any deficiencies in D3803, but because be don't believe we can get a sample that means anything. Until there is some requirement, such as use of test canisters with flow measuring devices on them, that assures the same flow through the test sample canisters as through the

rest of the filter, you are probably going to need some sampling design changes because charcoal packs down when you get closer to the bottom of the bed than the top. Until all these problems are resolved, I really don't think there is an awful lot of point fiddling around with D3803.

KOVACH: I am in full agreement with you.

FREEMAN: I think that John Pearson's issue is relevant. That is the issue facing most of the clients that I am dealing with. They have problems with the 1% penetration, 30° C, and 70% R.H. test. I think that, based on the results I have seen in my laboratory, a 1% penetration would be an unrealistic criterion to put on the charcoal. To say, it is "bad" charcoal, because it had 1% penetration at 30° C and 70% R.H., is not in agreement with what we have been doing all these years.

HAYES: I would like to respond in two ways. First, I would like to say that I think it would be valuable if both you and John presented papers at the next Air Cleaning Conference indicating what you believe is the true capability of charcoal. You state that, based upon the relative humidity of the system from which it comes, the charcoal will do this or that. In terms of what licensees can do, they can come in with a submittal that says instead of claiming 95% total efficiency, we are going to claim 88%. And then, depending upon whether they have heaters or not, you are talking about roughly 96% or 97% removal efficiency (3% or 4% penetration). Do you believe they can live with those values?

FREEMAN: My suggestion was 95% in the paper I gave. That is reasonable. The problem is, after they claim a penetration, whether they will violate their eventual calculated release.

HAYES: That is correct, the two go hand-in-hand. Therefore, if you assume an adsorber efficiency, you have to assure that the dose will be below the requirements of Part 100, or GDC 19, whichever one is more limiting. In most of the recent accident evaluations that I have done, there has not been a problem with offsite releases in terms of meeting Part 100. But we have run into problems with the control room operator doses meeting GDC 19. The big problem is the in-leakage which is assumed initially, to be 10 cfm, but is grossly underestimated. The real value is much larger and it is usually compensated for by the higher adsorber efficiency in the dose calculations. That is the way the criterion of GDC 19 is met.

FREEMAN: I think only some plants have real problems. I think what you're saying refers to a plant that has a spent fuel pool system that has problems. They were replacing charcoal at 1% penetration. I am not sure how that protects the public when the source term is going to change eventually and the calculated source term is outdated to begin with. It is convoluted, don't you think.

HAYES: For that specific example, I would offer the following: First, the fuel handling accident analysis would not be a function of the new source term. The source term remains unchanged. Second, I believe that the standard review plan limit of 75 rem for the thyroid would not be exceeded even if no credit were taken for the adsorber at many installations. Even those who have filter systems with capabilities that perform less well in terms of charcoal efficiency can probably go with lower adsorber efficiency and still be within the NRC standard review plan design doses. I think that may be a possible solution to this problem.

KUMAR: The question of ninety percent efficiency for old charcoal came up at EG&G. You need 99% efficiency initially when you buy charcoal. If we can't reach it, where do we stand, will our Tech. Spec. be changed? Are they going to change refueling outages? These questions come up. The basic thing is, we have to use 97% and 90% for new and used charcoal. How the technical specifications are going to be tied together, should be thought about clearly. I think that is very important.

KOVACH: I will comment on the first part. Another thing that is not really made clear by most purchasers of new carbon is what they want. Sometimes they put together specifications that conflict with each other instead of saying, we want a carbon based on N-509 requirements except for an efficiency of 99% instead of 97%. Carbons are available that are significantly better on a penetration basis. You can get carbons that are 3 to 4 times better than those currently required. But the tendency of people who write specifications for carbons is never to delete old specifications. They leave the old one in and then add all the new ones until you can give them almost anything because their specification ultimately calls for anything from carbon meant for Noah's Ark to something that is in draft form. So, if you specify what you want, you can get carbon that is better. As Jack Hayes mentioned, the source term we are talking about revising is the core source term. Reg. Guide 1.52 was not based on the core source term but on an efficiency based on accident conditions in the containment, during fuel handling, and for other conditions. So, let's not blame everything on the source term. There is no clear agreement about what can be done. Then we get into a public discussion and people talk about what they are forced to do. I think that we are passing the buck around. It would be much simpler to get an informed group from NRC, utilities, vendors, etc. to sit down and straighten this thing out in a very short time.

KUMAR: I think that is the right way to go.

JACOX: How are we using this data to improve the performance of the system? Could ISNATT or CONAGT use this type of data to inform relevant parties outside the immediate air cleaning community who have input to the NATS.

KOVACH: I agree totally. Thank you for the comment. I think ISNATT is perhaps the organization best suited to pass on this information and will formally suggest to the membership that the project be undertaken.

CLOSING COMMENTS OF PANEL MODERATOR KOVACH

I feel that we did make improvements, as Dr. Gill stated. I think that the discussions we had here were on a higher level then in the past, and I think there is now a better understanding of the problems. We hope that changes will not be made on a plant-by-plant, or a region-by-region basis, but that we can come up with a uniform, standardized procedure for power plants. I think they are scheduled for the year 2005 so we are not trying to set too short a schedule. However, I think this is a small problem that those who are involved in air cleaning can resolve without major problems. I think that if the standard Tech. Spec. modifications relating to testing are copied in exactly the same way from all utilities, we would not have to wait four years for changes. It could go a little faster if the same thing that has already been done and approved for some of the plants were extended to all. We should spend a little effort and money on technical discussions with audiences such as this one. I think that we could justify the cost/benefit of doing this. But at the same time, I would hate to go through the reverification of all the various test conditions. There is still a tendency by some people at times to pick some conditions for which there is no solution and I think we have to stop it. I think we are on the right road and it would be very beneficial to convene a task group from headquarters, the regions, ASME-CONAGT, ASTM, and several of the utilities to come up with a draft recommendation to address the problem. Then the draft could be sent to everyone for review and additional input to arrive at a common approach to solve this problem. I think that approach would resolve the issue a little faster.