SESSION 3

PANEL SESSION: APPLICATION OF NUCLEAR AIR CLEANING AND TREATMENT CODES AND STANDARDS

Monday: July 25, 1994
Co-Chairmen: J. Jacox
C. Graves

Panel Members: G. Sherwood
B. Mokler
T. Arndt

OPENING COMMENTS OF SESSION CO-CHAIRMAN JACOX

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PANEL DISCUSSION

OPENING COMMENTS OF SESSION CO-CHAIRMAN JACOX

The title of this session is Application of Nuclear Air Cleaning and Treatment Codes and Standards. We are not going to limit it, but it will be oriented toward DOE facilities, because we have been talking primarily about NRC facilities for 22 conferences. We are fortunate that we have panel members from DOE headquarters, users, and consultants, so we can get a variety of viewpoints. We will start with relatively brief papers, so you will have an idea where we are coming from, and then leave at least an hour for open discussion. I think it is a subject that should engender a lot of questions and discussion. And if we do not get enough discussion from the floor, I, personally, have a couple of questions I want to ask the other panel members.

HEPA FILTER TESTING - DEPARTMENT OF ENERGY OFFICE OF NUCLEAR ENERGY FACILITIES

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Abstract

This paper provides the background of, and some results from, a review of HEPA filter testing during 1993 at selected Department of Energy (DOE) facilities. Recommendations for improvements in standards resulting from the review are also presented.

I. Introduction

Testing of HEPA filters at selected Office of Nuclear Energy facilities was reviewed during 1993, by a team of well qualified reviewers. Members of the team were the following:

George L. Sherwood, Office of Nuclear Energy, DOE
Ronald C. Scripsick, Los Alamos National Laboratory
Brian V. Mokler, Environmental Health Services, Inc.
John Brockmann, Sandia National Laboratories
James E. Martin, University of Michigan

The review started following preparation and distribution of an information request (Figure 1) and analysis of responses to it (Figures 2 and 3). Details of the review will be provided in Brian Mokler's paper to be presented later in this conference.

The following preliminary observations resulted from the review:

1. Testing of HEPA filters at all NE facilities except the Portsmouth Gaseous Diffusion Plant is adequate.

2. Testing of HEPA filters at these sites can and should be improved.

3. Additional support for HEPA filter testing should be provided.

4. HEPA filter testing standards should be improved.

Each of these observations is explained in turn in the following paragraphs.

INFORMATION REQUEST (10/22/92)

1. LISTING OF HEPA FILTERS IN USE

2. TESTING PERFORMED

3. TESTING REQUIREMENTS

4. ASSISTANCE?

FIGURE 1

RESPONSES
(12/92 TO 3/93)

- o GDPs
  - PADUCAH
  - PORTSMOUTH
- o REACTORS
  - HFIR
  - BMRR
  - HFBR
  - EBR II (AND SUPPORT FACILITIES)
- o OTHER
  - MOUND (BLDGS 38 AND 50)
  - SAVANNAH RIVER (BLDG 235-F)
  - LANL (TA-55/PF-4)
  - ORNL (REDC AND IEF)

FIGURE 2

NE HEPA FILTER USAGE*

SERVICE	#
URANIUM/UF_6	~ 200
PLUTONIUM	~ 300
REACTOR EXHAUST	~ 200
OTHER	~ 300
TOTAL	~ 1000

*2' x 2' x 1' (1000 CFM)

FIGURE 3

II. Discussion

A thorough review of HEPA filter testing at NE facilities was completed during 1993. Testing was being performed, at all facilities but one, in a very professional manner. Testing was being performed as required, by experienced, well trained personnel. There were no serious gaps or flaws in the testing. However, sampling conditions for testing were often less than optimum. In addition, the depth of knowledge of HEPA filter testing at some facilities was less than desirable. Sampling is the area of HEPA filter testing where improvement and additional support should be provided.

This review has pointed out some areas where standards for HEPA filter testing can and should be improved, as follows:

1. Although HEPA filters used in most instances at NE facilities had been pretested at DOE filter test facilities prior to installation, this pretesting is not required in any of the standards or in any DOE Orders.

2. The HEPA filter standards may be too specific in some areas. In particular, flexibility and/or additional provisions in standards are needed for such variations as

    a. Testing multiple HEPA filters simultaneously,

    b. Allowing for ranges in rated air flow,

    c. Permitting alternative measuring devices (i.e., laser light scattering systems in addition to photometers), and

    d. Dealing with situations where the sampling conditions are not ideal (e.g., sampling ports not at least 10 duct diameters downstream).

III. Recommendations

The following recommendations are offered, with the hope that they will be responded to positively.

1. Provide Quality Assurance support not only for the DOE HEPA Filter Test Facilities, but also for the various organizations performing testing at DOE facilities.

2. Consider modifying existing HEPA filter standards to address the following; testing multiple filters

simultaneously, variations in air flow, use of alternative testing methods, and allowances for non-ideal sampling.

3. Make the practice of pretesting HEPA filters for use in DOE facilities an absolute requirement.

References:

1. LA-12763-SR (Status Report),
High Efficiency Filter Systems
General Observations, 1992-1993,
Los Alamos National Laboratory, May 1994

2. Safety and Health Issue,
ISS-92-6, HEPA Filter Testing,
U.S. Department of Energy, NE-80, 10/22/92.

AN EXAMPLE OF A COMPONENT REPLACEMENT WHEN APPLYING ASME N509 AND ASME N510 TO OLDER VENTILATION SYSTEMS

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Abstract

This paper presents an example of a component replacement (electric heater) when installed in an older ventilation system that was constructed before the issuance of ASME N509[1] and N510[2]. Many of the existing ventilation systems at the Hanford Site were designed, fabricated, and installed before the issuance of ASME N509[1] and N510[2]. Requiring the application of these codes to existing ventilation systems presents challenges to the engineer when design changes are needed.

Although it may seem that the application of ASME N509[1] or N510[2] may be a hindrance at times, this does not need to occur. Proper preparation at the start of project or design modifications can minimize frustration to the engineer when it is judged that portions of ASME N509[1] and N510[2] do not apply in a particular application.

I. Introduction

Westinghouse Hanford Company (WHC) must comply with the U.S. Department of Energy (DOE) Order 6430.1A, *General Design Criteria*[3]. The order states in part "These criteria apply to any building acquisition, new facility, facility addition and alteration, and leased facility that is required to comply with DOE Order 4300.1B[4]. This includes on-site constructed buildings, pre-engineered buildings, plant-fabricated modular buildings, and temporary facilities." DOE 6430.1A, Section 1550-2.5.5, titled "Air-Cleaning Devices," requires that all high-efficiency particulate air (HEPA) filtration systems comply with ASME N509[1] and be tested in accordance with ASME N510[2].

In addition to DOE Order 6430.1A[3] requiring ASME N509[1] and ASME N510[2], RLIP 5480.4C[5], titled *Environmental Protection, Safety, and Health Protection Standards for RL*, Section 10, "Nuclear Safety Standards," paragraph b, "Nuclear Facility Safety," also invokes ASME N509[1] and ASME N510[2] as mandatory standards.

II. Existing Ventilation Systems

Many of the existing ventilation systems at the Hanford Site were designed, fabricated, and installed before the issuance of ASME N509[1] and N510[2]. Requiring the application of ASME N509[1] and N510[2] to existing ventilation systems presents challenges to the engineer when design changes are needed.

The following example will attempt to illustrate complications that are encountered when applying ASME N509[1] and N510[2] to older ventilation systems that were constructed before the issuance of these codes.

Replacement of a Steam Heater with an Electric Heater

ASME N509, paragraph 5.5, states "Heaters shall be electric and capable of meeting the requirements of paragraph 4.5 of this standard."[1]

Many of the older ventilation systems are installed using steam heat. When a modification to the exhaust train is required (i.e, a new HEPA filter housing is being replaced), problems are encountered when the use of a steam heater is requested. ASME N509 states "Heaters shall be electric and capable of meeting the requirements of paragraph 4.5 of this standard."[1] In some instances, requiring electric heat also requires the addition of electrical power because of the unavailability of power where the heater is located. The addition of the power will also require an electrical upgrade to meet the current electric code requirements.

In addition, within the tank farm complex certain tanks contain hydrogen. For tanks that contain certain levels of hydrogen it is required that ventilation systems and their components must be intrinsically safe.

A conflict arises when applying paragraph 5.5 of ASME N509.[1] Because an electric heater is required, the system cannot be intrinsically safe because of the amount of electric energy required to heat the gas stream. On the other hand, a steam heater will satisfy the requirement.

Where the intent was to use the existing steam heater and keep costs reasonable and within budget, now it becomes more costly and complex because an electric heater must be installed instead of reusing the steam heater.

III. Summary

ASME N509[1] and N510[2] are mandatory codes required by DOE Order 6430.1A[3]. Applying these codes to older ventilation systems that were constructed before their issuance is often frustrating. Often simple modifications can improve system performance, but the design will not progress unless full compliance to all the code requirements are adhered to.

Although it may seem that the application of ASME N509[1] or N510[2] may be a hindrance at times, this does not need to occur. Proper preparation at the start of project or design modifications can minimize frustration to the engineer when it is judged that portions of ASME N509[1] and N510[2] do not apply in a particular application.

If the engineer can provide a technical justification for deviation from ASME N509[1] or N510[2] and the justification will demonstrate that another method would be technically similar or produce the results intended by these ASME codes, then a waiver can be requested from the DOE for deviation.

DOE Order 6430.1A allows for waivers from the *General Design Criteria*, provided the deviation follows specific guidelines.[3] The following is quoted in part from Section 0101-2, titled "Criteria Deviations."

> For all projects subject to DOE 6430.1 series, these criteria are not intended to impose unnecessary design restrictions or requirements or to discourage design innovation. Professional architectural and engineering judgment shall be used in the

interpretation and application of these criteria to specific projects.

The contractor and/or DOE organizations responsible for facility projects shall review these criteria early in the planning phase and at later phases during the project construction process to determine if any of these criteria are not applicable or are not appropriate.

The contractor shall document the criteria being used for each project in the project's SAR (per Section 0110-5.2, "Safety Analysis") such that compliance with these criteria can be verified during design, construction, and facility operation. Site-specific criteria shall be included in this documentation.

The principal objective at the Hanford Site is to provide safety to personnel and the environment. The ASME N509[1] and N510[2] are necessary and aid in preventing unsafe HEPA filtration systems from being designed and installed.

If, in the opinion of the engineer, a particular paragraph does not apply, then the responsibility rests upon the engineer to convince the appropriate personnel that, based upon technical justification, a waiver from ASME N509[1] or N510[2] is warranted.

Frequently a simple modification will enhance the system performance and become safer than no modification at all.

IV. References

1. ASME N509, *Nuclear Power Plant Air Cleaning Units and Components*, ASME N509-1989, American Society of Mechanical Engineers, New York, New York.

2. ASME N510, *Testing of Nuclear Air-Cleaning Systems*, ASME N510-1989, American Society of Mechanical Engineers, New York, New York.

3. DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C.

4. DOE Order 4300.1B, *Real Property Management*, U.S. Department of Energy, Washington, D.C.

5. RLIP 5480.4C, *Environmental Protection, Safety, and Health Protection Standards for RL*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

A Single Standard for In-Place Testing of DOE HEPA Filters - Not[1]

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In order to understand why I think it is inappropriate to apply a single in-place testing standard to all HEPA filter installations at U. S. Department of Energy HEPA facilities, I need to explain my views on two basic issues. The first is what is meant by "standard." To me a test standard is a document that specifically includes all procedures that **must** be completed to conduct a test. Acceptable tests are only those performed in strict accordance with these procedures. No options, additions, or alternatives are allowed by a standard. In this idealization of a standard the directions are all phrased in terms of "shall." To the extent procedures are written permissively, allowing options and alternatives, the document becomes less of a standard and more a description of suggested good practice.

The second issue is the variety of DOE HEPA systems that require in-place testing. They encompass a very wide range of design and construction practices. Many of the systems were designed and built before the virtues of and need for in-place testing were recognized. It would probably be possible, with minor modifications to the existing hardware, to adapt some systems to allow use of a standardized in-place test. In other cases, extensive modifications would be required. Finally, there are some systems that may have to be replaced before accurate in-place testing data can be obtained. In the latter two cases, we must recognize that many of the facilities served by these HEPA filtration systems are nearing the end of their technical and economic usefulness. Careful consideration must be given to all possible methods of risk management. Is it reasonable, on both practical and economic grounds, to use limited resources to retrofit these systems so they could, for a short time, be tested in exactly the same way newer systems are tested? Can the same ends be achieved by other means such as administrative controls?

These two issues do not mean that we cannot or should not test the performance of HEPA filter systems. The problem is to do it so that the measurements are as representative as possible and their limitations are understood and acknowledged. Both the reporting of the results and the required performance specified for a system must recognize that a calculated penetration and the aerosol concentration measurements from which it is derived are not absolute values, free of all uncertainty. Uncertainties in the measurements arise from several factors, primarily system design, sampling problems, and test instrument performance. Technically, we probably can measure aerosol concentrations with more assurance than we can establish that the measurement is representative of the average concentration at the sampling plane. The difficulty with many of the sampling locations on older HEPA filter systems at DOE facilities is that there has been no documented effort to establish the quality of the sample available when the facility's routine sampling procedures are followed. Before efforts are made to correct these problems, it would be appropriate for DOE to provide guidance to facility operators on what DOE expects to be accomplished by in-place testing. For example, are in-

place tests to be used only to detect gross system defects or are they also expected to verify that system performance meets design requirements? This guidance should be primarily technical in nature, stressing the need for valid measurements and describing means of achieving this goal. The guidance should also provide an approach for facilities to use in revising performance specifications to allow for the uncertainty inherent in filter bank penetration determinations.

HEPA filter installations at DOE facilities must be tested regularly to verify that they provide the filtration performance required of them. The test results must be an accurate measurement of the performance. It appears very unlikely that a true standard could be written to properly describe the testing requirements and procedures for all DOE HEPA filter installations. It would be more appropriate for DOE to provide guidance to its contractors on required elements of testing programs and models of good engineering practice associated with these elements. This guidance should provide a clear statement of DOE's expectations for in-place testing while being flexible enough to meet the needs and constraints of the wide variety of systems found at DOE facilities.

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[1] Work performed under U.S. Department of Energy Contract No. W-7405-ENG-36 with primary support from the Office of Nuclear Energy Self-Assessment - formerly NE-80, now NE-1.2, Quality Assurance Staff.

[2] Environmental Health Sciences, Inc., contractor to Los Alamos National Laboratory.

23rd DOE/NRC/ISNATT NUCLEAR AIR CLEANING AND TREATMENT CONFERENCE

INTEGRATING INDUSTRY NUCLEAR CODES AND STANDARDS INTO UNITED STATES DEPARTMENT OF ENERGY FACILITIES

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JACOX ASSOCIATES

Abstract

Recently the United States Department of Energy (DOE) has mandated facilities under their jurisdiction use various industry Codes and Standards developed for civilian power reactors that operate under U.S. Nuclear Regulatory Commission License. While this is a major step forward in putting all our nuclear facilities under common technical standards there are always problems associated with implementing such advances. This paper will discuss some of the advantages and problems experienced to date. These include the universal challenge of educating new users of any technical documents, repeating errors made by the NRC licensed facilities over the years and some unique problems specific to DOE facilities.

Introduction

As early as the 1960s, there have been Industry Codes and Standards for Nuclear Power Plants. These were first written when the original federal government agency for nuclear facilities was the "Atomic Energy Commission" (AEC). At the time, the AEC had jurisdiction of all United States nuclear facilities. Over the years, this common regulatory control has been split and gone through a number of political incarnations. This split responsibility has created a diversity of technical and engineering approaches to many common situations. With the recent decline in funding of weapons research and production, along with the great increase in "environmental" concerns, the use of common technical and engineering approaches as well as common hardware has again become the order of the day. In the area of nuclear air/gas treatment, this new commonality is mandated by DOE Order 6430.1A, "General Design Criteria" which requires, through various references, that all HEPA filtration systems comply with ASME N-509 "Nuclear Power Plant Air Cleaning and Components" (1) and ASME N-510-1980 "Testing of Nuclear Air Treatment Systems" (2). A revision of this DOE Order is being worked on that will add a third ASME document on Nuclear Air/Gas Treatment, ASME AG-1 "Code On Nuclear Air and Gas Treatment Systems" (3). When, or if, this revision will be issued is not known to the author. While there are many other industry Codes, Standards and documents that are also now mandated for DOE facilities, this paper will discuss these three documents and the related air and gas treatment systems they are mandated for application to. Note that the 1980 editions of N509 and N510 have been superseded by 1989 editions and are no longer in print.

The first and main point to keep in mind when using N509 and N510 is that through their currently three editions they have been written for a very specific application. This is to design, fabricate and test filtration systems for pressurized light water power reactors Licensed by the NRC. Even more specifically they are for systems intended to mitigate the consequences of a design basis accident as specified in NRC Regulatory Guide 1.52 (4). And even further, the gaseous contaminant of interest is primarily radioiodine 131. These documents have been reasonably successful in meeting the needs of the nuclear power plants for design, fabrication, commissioning, operation and maintenance of the subject systems. However, everyone using these Standards must always remember their specific and limited scope and intent. This is not to say they are limited, as excellent technical guidance, to only the Regulatory Guide definition of systems but there is a vast difference in using a Standard for technical guidance and "to the letter" bureaucratic enforcement of a Standard.

As a point of interest, the United States Department of Defense is also converting to industry standards as much as possible and is encountering essentially the same problems as the DOE has encountered.

Discussion

There are obvious and significant advantages for DOE facilities using Industry Standards. The Codes and Standards have evolved over decades and are, in most cases, very realistic from both technical and cost standpoints. As Industry consensus Standards they have been developed by manufacturers, users, regulators and other technical experts. These standards have been subject to public review and the ultimate test, actual use. Cost savings result from commercial industry input from the start and from economies of scale from using "standard" components, design, testing and integration. Additionally, there is a very large body of literature on these filtration systems. This is primarily in the Proceedings of these International Conferences. All these features add up to the ability to use well-proven components and systems. Unfortunately, the comprehensiveness of this material, physical and informational, means new users have considerable material to learn before they can properly benefit from it.

This self education phase is particularly difficult today given the scope of the environmental problems the DOE technical community is mandated to resolve, the great budget pressures to reduce costs, the ever increasing media attention to every detail of cleanup efforts and the somewhat insular working environment of DOE facilities worked in until recently. Engineers are trying to solve serious technical problems, often created decades ago, with limited time and resources, under politically created schedules and being second guessed every step of the way by non-technical insiders and outsiders. This leaves little time for the study required to fully understand the technical background and nuances of the newly mandated Standards. Further complicating the situation is the limited scope of these Standards. The author, as a consultant, as a member of the writing Committee - The "Committee On Nuclear Air And Gas Treatment" (CONAGT), sponsored by the American Society of Mechanical Engineers - and through many discussions with colleagues from all areas of involvement, has seen problems from use of N509 and N510 without true understanding of their content and scope. One of the most basic problems is "over-specification." This is usually done by someone who has not read and understood the documents he specifies. An example is specifying too many related, but not totally consistent, industry and government codes, Standards, Guides and Military Specifications. The most common error is to specify N509, N510 and AG-1. These are very similar documents in most ways but are NOT identical. Worse, the specifier may either mix editions or not specify the edition at all. The meticulous vendor will attempt to explain the often subtle problems that arise from this type of mis-specification but many vendors simply ignore them. Unfortunately the buyer, who is not as familiar with the documents, may prefer to work with the vendor who does not ask questions or "cause him trouble." This approach simply puts off the questions from the early stage when they are only on paper to the final stage when they are now hardware. Even a basic component such as the HEPA filter can be mis-specified very easily by referring to more documents than is necessary. This is detailed in a paper from the last Conference entitled "Review of HEPA Filtration Test Standards and Their Application to Nuclear Applications" (5).

Another all too common error in using the standards is simply not understanding exactly what you are specifying when invoking them contractually. Usually the result of this lack of understanding is not getting the performance and/or physical quality required. Vendors usually interpret requirements in the lowest cost manner. This may or may not actually meet the Standard but regularly does not result in a component or system that meets the users requirement. Worse, in nearly every case, the user does not return the item and require the vendor to correct the deficiency but somehow lives with the substandard item because of schedules. It appears that while there is never time to properly understand, specify, oversee, shop inspect, and test items there is always some technical or "paper" way to make deficient items acceptable to meet a schedule. Certainly this is a universal challenge for all complex technical endeavors, but the mind set of using Codes and Standards to the "legal letter" in all nuclear facilities can not replace good engineering experience, judgement, and understanding. Of course, Codes and Standards are not perfect. We who write them are painfully aware of this fact and always welcome constructive feedback on how to improve them. Any written comments to the sponsoring organization are formally transmitted to the responsible committee and given full consideration for inclusion in revision, addenda or correction. However, no Code or Standard can substitute for competent engineering and Quality Control by a user. Whether a deficiency arises from mis-application of a standard, mis-interpretation by the user or vendor or simply from the vendor not fully meeting the Standard requirements, such deficiencies are and must be the responsibility of the buyer/user. A set of major filtration systems costing millions of dollars purchased by a DOE facility was seriously deficient in a number of areas which were blamed by the vendor on poorly written sections of ASME AG-1. The vendor did not meet some

minimum dimensions called out in the Standard. After very lengthy investigations, discussions and formal inquiries the decision of CONAGT was that the Code Section was adequate and accurate and the problem resulted from inadequate buyer understanding and oversight of this vendor. If the buyer's responsible organization had more experience with the Standard used, this expensive problem would probably been avoided. This example includes the overlapping problems of becoming educated in the details of new documents and not repeating mistakes already made. Closer cooperation and cross education between NRC and DOE facilities will help reduce many repeat problems and headaches.

Complicating these general problems and learning curves there are unique circumstances that exist at DOE facilities making the challenges even greater. These circumstances are both technical and regulatory - administrative in nature. No other facilities have such considerations as criticality in liquid or gas/aerosol streams. Power plants do not have the problem of mega-curie sources in unknown chemical brews that generate heat and hydrogen in ways not totally modeled. Plutonium dust is encountered only in DOE facilities. All these and related technical details greatly complicate the use of Codes and Standards not written with them as a part of the documents scope. Administrative misunderstanding of the scope, intent and use of the documents also creates considerable problems for the user's technical staff.

Since the current versions of these documents do not address criticality, gases other than air with radioiodine and minor impregnated carbon poisons, corrosive or toxic gases or high temperature process flow, they must be augmented for many DOE facility projects. CONAGT is working on broadening the scope of AG-1, but the new Sections and revisions of existing sections will take years before they can be published. The Committee needs specific direction from the DOE facilities as to what is needed, the qualified technical members from DOE to help write the new Code Sections. All of these points do not invalidate the technical content of the three documents, they do point out their mandate has not eliminated the need for good engineering in design of new systems and upgrading of existing ones.

At the Hanford site where there are some waste storage tanks that contain highly radioactive liquid - or semi-liquid sludge - complex chemical mixtures. Equipment definition for the ventilation of these tanks; during material transfer, "breathing", to remove heat or to reduce an explosive hazard requires the system to handle complex organic and inorganic gaseous chemicals and prevent their release to the atmosphere is nowhere in N509 or AG-1 - directly. There is excellent technical guidance on how to build the different types of components required to process these chemicals. The successful combination of new technology with existing Codes and Standards is very difficult technically and nearly impossible administratively. It must, however, be accomplished.

The major administrative problems at present are: 1. That AG-1 has not been mandated and some facility administrations interpret this to mean it can not be used at all. 2. The interpretation that unless a component is explicitly defined and detailed in N509 it can not be used at all. 3. That industrial experience, no matter how extensive, can not be used to justify use of existing technology for nuclear application. Of course there are theoretically means to get around these road blocks, but the expenditure of resources to do so can exceed the productive engineering design effort. A suggested solution to many of these quandaries is for the DOE facility technical AND administrative personal to learn the intent of these documents formally from the writing Committee, CONAGT.

Being able to use the latest edition of AG-1 will be of significant help to most DOE sites. It is very much broader in scope than N509 and covers many more types of components. For example, in N509 the only type of heater covered is electrical which is not acceptable for potentially explosive process flows. AG-1 includes steam heaters which solve this problem. There are many other component types included that offer far more flexibility in design. AG-1 is made up of many Sections that are revised and expanded individually so it provides an easier and faster means to respond to industry needs. Additionally formal inquiries to ASME are possible to obtain binding new information and answers to questions until a new revision to the code is issued.

Conclusions and Recommendations

The main conclusion is that the use of Industry Codes and Standards such as ASME N509, N510 and AG-1 will benefit the facilities that use them, technically and economically. This statement is tempered with the strong caution that it will only be true if the documents are used in a proper and enlightened manner, both technically and administratively. Improper or overly restrictive use of these or any Codes and Standards can result in unnecessary expenditures of resources and, worse, inadequate system performance.

Users of these documents must fully understand them and their intent to benefit from their use. This applies to both the technical and administrative user. Some formal courses and training is available for the use of these documents. Harvard has an annual course, ASME has (usually) semiannual seminars and commercial training exists. All should be taken advantage of as well as using the experience of the Power plant industry.

Care should be taken to understand when a DOE facility situation, or part thereof, is truly unique and demands unique engineering and when it has a history in other areas, nuclear or industrial. We must use valid experience from what ever source we can find. When we waste resources reinventing a wheel, it is not only expensive but seldom round.

Maximum long term benefits of bringing the nuclear industry under a consistent set of Industry Codes and Standards will be obtained by both the DOE and NRC if their personnel teach and learn from each other. The DOE facilities must support the modification and expansion of Industry Codes and Standards by providing direction for their needs and qualified engineers to help write them. The existing committees must be actively open to the new challenges of supporting these new facilities and seeking out new members. Historically, CONAGT has sought out new members and had a very open policy for including new technical areas. I hope this paper will motivate DOE facility engineers to join CONAGT, ISNATT (6) and other necessary committees and related organizations for the benefit of all of us in the nuclear industry. Many members of these organizations are here at this conference. Feel free to ask any of us about membership.

References

1. ASME N509-1989; "Nuclear Power Plant Air Cleaning Units and Components", American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

2. ASME N510-1989; "Testing of Nuclear Air Treatment Systems", American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

3. ASME AG-1 1991; "Code on Nuclear Air and Gas Treatment Systems", American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

4. USNRC Regulatory Guide 1.52; "Design, Testing and Maintenance For Atmospheric Cleanup System Air Filtration and Adsorption Units of Light Water Cooled Nuclear Power Plants", Revision 2, March 1978, USNRC, Washington, DC 20556

5. Jacox, J., "Review of Filtration Test Standards and Their Application to Nuclear Applications", 22nd NACC, 1992, CONF-9020823, Superintendent of Documents, USGPO, Mail Stop SSOP, Washington, DC 20402-9328

6. ISNATT "International Society of Nuclear Air Treatment Technologies", P. O. Box 29246, Columbus, OH 43229

PANEL DISCUSSION

JACOX: I have some additional comments before we start the general discussion. Over the years I have worked with a manufacturer, with a testing and consulting firm, and as a consultant to DOE facilities, and can see the problems from most points of view. In regard to how DOE is trying to apply the standards, N-509 and N-510, Tim Arndt said it seems like a hinderance at times. He is a bit more generous than I. I think it's a serious hinderance, at least the way that the Hanford site is trying to apply it.

Here is a little bit of background. When you look at the scope and the limitations of both N-509 and N-510, it becomes apparent they are written for an extremely specific and limited purpose, and that is to meet the requirements of Regulatory Guide 1.52, which applies to engineered safeguard systems to mitigate the effects of a design-basis accident in light water reactors under NRC regulations. That is all these documents are written for. N-510 is written to go with N-509, but it must be done on an edition-by-edition basis because there are three pairs of these documents having dates '75-'76, '80-'80, and '89-'89. You can only apply N-510 to its companion N-509 edition to do things to the letter. Even NRC licensed facilities have a problem with that.

When a DOE facility tries to use these documents to the letter, rather than the spirit, they are making them impediments to doing anything correctly. There is, as Tim Arndt said, a way to get around it, but often you spend a lot more time, money, and effort getting a waiver to this administrative error (which is what it is when you are forced to use a document or a standard incorrectly), than if you just were doing the basic engineering. This is going to come out, I am sure, in our discussion. There will be a panel tomorrow afternoon, chaired by J. L. Kovach, that is strictly on gas processing. I recommend both Kovach's paper and the panel as they will, to a large extent, be a continuation of what we will be talking about here.

As a point of interest, the Department of Defense started using the N-509 and N-510 standards some years ago for some of their applications. They have been using nuclear industry technology on an *ad hoc* basis for the last fifteen or twenty years for air filtration of the safeguard missile silos at Cheyenne Mountain NORAD Defense Center, and in a number of other areas. I have a friend here who has been involved in the filter systems at Johnston Island for war gas demilitarization, and I am sure he could give some examples of the problems that arise when using a limited nuclear standard for other applications, and trying to do it to the letter rather than to the spirit of the standards.

One of the big differences between a DOE facility and an NRC regulated facility is that in an NRC regulated facility for light water reactors you will not see megacurie doses of anything except noble gases. You are not going to see chemical processing lines in power reactors. In DOE facilities these are chemical engineering processes. For the NRC regulated facilities that are designed to mitigate accidents, you design for a short-term use. These systems don't have to run for a long time. People may differ over the definition of an adequate source term, but the chemistry of a nuclear accident is somewhat better defined than the extreme range of conditions you can get in processing at DOE facilities. Long term versus short term requirements have not been discussed very much lately, but they are going to be discussed in some detail during tomorrow

afternoon's session.

The misapplication of a standard or code, any code or standard, is a very bad thing. The idea of using existing technology, which is why DOE is recommending the use of what the NRC has been using, is great, and when properly applied, could save everybody a lot of time or money. When we say DOE, we are talking about our time and money as taxpayers. Therefore, I think we should all be very much in favor of using existing technology. I certainly am. But when you misapply technologies, you waste a lot of time and money. So I am hoping that the discussion today, the panel tomorrow afternoon, and a number of formal papers will bring to light all of the problems. Their solution is simply to apply the spirit of the guidelines, rather than the blind administrative letter of the various documents.

The last point I want to make before we start the panel discussion is that ASME's Committee on Nuclear Air and Gas Treatment, CONAGT, is responsible for N-509 and N-510, plus a new code, which is much broader, called AG-1. AG-1 has not yet been approved for use by DOE. By simply doing that, it would eliminate quite a few of the current problems. CONAGT discussed this whole area last week and came to the conclusion that if we are going to have AG-1 used by DOE, we will need new CONAGT members who have the appropriate expertise. If anyone here has expertise in these areas, please see me or stop at either the ISNATT booth or the CONAGT booth and offer your help. Now, I would like to invite everyone to bring up whatever questions or comments they wish, and we will do our best to, at least, discuss the points, even if we can not answer them directly.

WRIGHT: We have been hearing about all the problems that we are facing and how standards are inadequate. It seems to me that standards that are adequate for the NRC may not be as adequate for the DOE, and the standard that will be written may or may not be different: I can't tell at this time. But here is a question for the panel. Can you, within a reasonable time frame, write a standard that makes sense for facilities that are not reactors, so that we can put this on the table and deal with it? Some of the facilities may be more dangerous than reactors, but most will be relatively benign, having an element of risk three, four, or five orders of magnitude below what you expect in a reactor. Within the DOE context, you have something called the S/RID, which is a process of identifying all of the applicable requirements for a facility, at which point you can call on a standard to do a job. However, you do not have to call on the standard in its entirety, you can call on those sections that make sense. Once it's approved, they become part of the basis for operating the facility. You also have at your disposal, on the DOE side, hazard categorization, which is the closest thing that we have to the Part 30, Part 50, Part 70 facilities in the NRC. You can write your standard in such a way that, when you are a hazard category 3, or below, you can invoke a specific level of a standard. But it seems to me that there are some solutions we can take, especially with a commitment to fix some of the DOE orders that are causing us all these headaches. And so, coming back to the essential question, can you achieve consensus and write a standard that makes sense, does the job, and does not put an onerous burden on the people that have to live under these standards?

SHERWOOD: I guess the answer is, I think so. I will be working on one soon. I have

already talked to the DOE standards writers, and you are more than welcome to join with us in that endeavor. We could use your help, to help us get consensus. I think we can write a standard fairly rapidly. The approval process at DOE, sometimes, is a little less rapid, and that might be the problem. But if we can get something in writing and get people responding to it, we are better off than we are today. And that's where I will be working after I get back to the office in Germantown.

JACOX: I would like to answer that from the standpoint of CONAGT. As I said, we discussed it, and, depending on what your definition of a relatively short time is, the answer is definitely, yes. And I agree that one of the most critical things in the use of any code or standard is that the people using it should invoke only the applicable parts, rather than invoking the whole standard. That is a serious problem in NRC-licensed facilities, when there is only one section that is really needed, but somebody invokes the whole standard. At some point you end up asking why we do all those things to ourselves. If the DOE is writing standards, it is very important that there will be some discussion. And I am not sure who the individuals will be. There should be good communication so that both CONAGT and DOE are not trying to do the same thing, or worse, trying to do the same thing in different directions. Ray Weidler (chairman of CONAGT), perhaps you could talk to the appropriate people, if you are not already doing it, to see that we get everybody moving in the same direction and most efficiently.

WEIDLER: As Jack Jacox has said, CONAGT is looking very seriously at expanding both AG-1, N-509, and N-510 to include DOE and DOD items. The definition of "a reasonably good time frame" is difficult because of the consensus process, and the fact that the Board of Nuclear Codes and Standards governs us. They, in turn, are governed by ANSI. So a code or standard requires approval of the CONAGT main committee, approval of the Board of Nuclear Codes and Standards, and then approval by ANSI. This can take up to five years. I will say that CONAGT is interested in expediting the process by getting these issues on the table and getting the codes and standards upgraded to address all DOD and DOE needs. We will be making a strong effort in the next year to get some writing effort under way.

KOVACH, L.: My full time affiliation is NUCON, International, but I will add DOE high level waste Technical Advisory Panel, as well, because I will be speaking with a forked tongue here. ANSI N-509 and N-510 were written because some of the architect-engineers were exercising all of their ingenuity. Originally, we had single reactors that had four or five different sizes of carbon adsorbers at the same site. So, it is not only that a standard is written to restrict people or to try to correct past mistakes, sometimes, it is written because of the horror of looking at existing systems. I have not seen a better installation average at DOE sites than at NRC regulated sites. There are some total abominations out there, installations that no decent architect-engineer in his sane mind could stand up and say that this is a good design, or this is an installation appropriate for the particular challenge. At the same time, we are looking at horrendous expenditures. We learned of one tank that was remediated at a cost of about $1.6 billion dollars, but there are more than 240 more out there. I never believe the budget that Westinghouse or DOE present. I always use a great multiplier on both the time and the money. But we cannot afford to have a separate design at West Valley, a separate design at Savannah River, a separate design at Hanford, a separate design at Rocky Flats, and all the other

places. We have to get to the point that anything that can be put on a common denominator will, in fact, be made uniform at all of the DOE sites, and that future construction, operation, and testing of air cleaning systems will be as uniform as possible, although some portion may have to be customized for certain applications. We are looking at air cleaning systems for processing that will be under continuous chemical and radioactive challenge for possibly twenty years. I hope that the melters will work that long. So far, we have spent more money on designing melters than on building them. It is a compromise, and within limits, I disagree with part of almost everything that is said, while I agree with some other parts. Regardless of how experienced the architect-engineers are, we are faced with some new processing problems that have been solved in very few places in the world. And we have to make sure that the common parts are standardized. For that I like to refer to the French approach because they certainly are more successful with their entire nuclear industry than we are. When you go into one of their reactors you know exactly where the air cleaning system is; it's the same size for all, and it's in the same place. The doors are the same, the components are the same. We will have certain processing equipment or area protection systems that will need to be identical, whereas some will need to be modified and good engineering judgement will be needed to back fit existing systems. It has to be done on a cost-benefit basis. Somebody should look at the uniformity of back fits, also, and not have a different back fit procedure at Hanford and a different back fit procedure at all the other sites. I started out in this business when it was still AEC operational safety for both agencies. At that time, several people, vendors, engineers, users, would sit down and come up with a common denominator approach. That was good at that time, but I don't think it will work ever again. Even though some past things were more successful than some of the things we are doing now, we can't repeat them. The consensus process for standards that we have now is very long. I am not sure we can come up with appropriate design criteria in time, particularly for Hanford, where they are now frantically trying to design a giant monolithic processing system. We cannot afford to leave another nuclear standard "memorial" to future generations. At the same time, if we all do something different, it will also create tremendous problems. So, my question to the panel is: what are the areas where we can achieve important uniformity, either by scissoring or mending current standards, and not let everybody go wild with their innovativeness at the particular sites? And which are the areas where we can afford to be a little more lenient, but make sure that an evaluation is made to justify deviation from the standards? But just shrugging off the problem by saying the standard was written for NRC, and therefore we have to drop the whole thing and start strictly on our own, is again, something that I don't think we can afford. There are a lot of good points in the current standards and I think we have to come to a compromise here. Some part has to be a rigid standard, but for some parts, there can be leeway when justified by engineering judgement.

SHERWOOD: One area that could be standardized a bit, but where there still could be some room for local modification, would be sampling itself. A lot of the sites with old facilities really cannot test according to all the requirements in the existing standards. There is not enough space and they can't get to the locations. The filters may have been installed too close to one another, and short of rebuilding the whole thing, you have to be able to modify testing to cover that case. Another one would be air flow. Some of the facilities have had drastic changes in air flow, and yet the same HEPA filters are still in place, performing for something like one third the load they used to get, in terms of

air flow or potential contamination. One area I would like to see more standardized within DOE is the requirement that the HEPA filters being used be pretested prior to installation. This is one place where DOE does more than others and it is well worth putting it into an absolute requirement, because in the long run you probably save more than the cost of testing.

MOKLER: An area that I think will require more flexibility, especially for older installations, is multiple-stage systems. Too often, it appears the goal is to test the individual banks, not to get accurate measurements of their performance. I believe there is a need for more flexibility in thinking about how we test multiple-stage systems and in describing how that test will differ from a standard test performed on a well-distributed, single bank system.

ARNDT: I also think that problems can be avoided when we start designing the systems. For example, during a conceptual design, or prior to when the FDC is being formulated, portions of the FDC may be able to stipulate certain sections of the codes that are, or are not, applicable, because then the proposal goes to DOE for approval. If DOE buys into it at that time, you are home free. But problems come in the FDC stage, when they put a blanket statement, in that all systems shall comply to ASME N-509 or N-510. The design agency takes it and may, or may not, in their judgement, feel that it is necessary. Then, at the 30% or 50% design review, someone else will start looking at quality assurance, safety, design engineering, and see a system that does not meet the letter of the law. This is, I think, when problems occur, whereas they could have been avoided in the initial stages. Now, because of cost and project scheduling, problems are encountered. But for a lot of existing systems, it is hard to standardize, because you have to retrofit. I feel that a lot of problems can be avoided if the appropriate people are brought in at the initial stages, at the design concept.

GRAVES: There is one tremendous advantage to using a standard even when you don't like to, and that is to use a standard as a starting point. While it is evident to me that some DOE facilities are not happy having to live with N-509 and N-510, they have the opportunity to avoid some of the bad things that they may have done in the past; certainly with air filtration. So, while N-509 and N-510 just do not fit, and it is somebody else's standard, it still is a tremendous advantage even when you feel that you have to take exception, chapter and verse. One of the problems in the light water nuclear power industry is that many mistakes get repeated until somebody latches onto the standard and finds a good design basis.

JACOX: In answer to some of Dr. Kovach's comments, I hope I didn't give the impression that I was saying that DOE should not use the standards. My point is that they shouldn't use them blindly, that is where the problem occurs. Even when we are talking about very similar sorts of applications, a requirement to meet all of the "to-the-letter type QA rigorousness" is the real problem. At least, I would like to think, having worked on them for nearly twenty years, that there is a lot of good technical content in the standards. However, given different applications, different source terms, and different situations, they should be used for technical guidance. As I mentioned earlier, in DOE there are chemical processing applications to which N-509, and even AG-1, the expanded code, simply do not apply, and, as guidance, there are certain large gaps. So, we do need some

kind of expansion. One of the points that Ray Weidler made was that it might take five years to get something approved. Having been involved with standard writing, I am painfully aware of that. Something other than a code or a standard that could be used by DOE, whether written by CONAGT, or by CONAGT in conjunction with DOE, or by DOE itself without CONAGT, would be of immense help in the application of good technical judgement based on experience and past mistakes. A bit of uniformity could result in a big saving.

WILLIAMS: I am with Parsons. We do decontamination and dismantlement. A lot of agencies, as well as DOE, call it decontamination and decommissioning, which essentially means the same thing. I had a question for George Sherwood. When you say you would like to have the HEPA filter pretest done, are you referring to the military standard, DOE's NEF 3-35, or the work done at Oak Ridge or Rocky Flats?

SHERWOOD: I am referring to DOE's HEPA Filter Test Stations that pretest HEPA filters before they are installed at DOE installations, particularly those at Oak Ridge and Rocky Flats, where I have visited and seen how they do the testing. I am satisfied they are doing a good job.

WILLIAMS: I agree with you totally. What we have run into, in the work we are doing at Fernald, is that we are an environmental remediation management contractor. We get paid faster and make more money if we get the job done quicker. When we have to send HEPA filters to Oak Ridge (Rocky Flats is not in our jurisdiction), it slows down the process. I agree with you that testing needs to be done at some centralized location, but in the case where we have to send things from our vendors, who are also doing tests to be sure that their products comply with the standards, then to Oak Ridge, and then on to Fernald, that slows down our lead time a lot.

SHERWOOD: Some of the DOE facilities that I have been to, for that very reason, have some pretested filters stored on site for immediate use.

WILLIAMS: That is another problem; we only buy what we need, and usually we require the subcontractor to buy them. We are no longer in the processing mode, we store nothing. Everything is subcontracted out. We, as a design firm, are the architecture-engineering firm. FERMCO is the managing contractor. We write performance specifications (sometimes hybrid designs/performance specifications and drawings) that the subcontractor utilizes to produce detailed work plans, drawings, or specifications. Nevertheless, we just don't have time to send HEPA filters from the manufacturer to Oak Ridge. We need to get them to the site as quickly as possible so we can get construction started.

SHERWOOD: You might want to look at something on the standardization issue that I did not bring up previously: I think we ought to take a real hard look at which HEPA filters need to be tested in-place and which ones do not. There is some variation among the DOE sites today on that very matter. I think everybody agrees that the filters on the main exhaust plenums need to be tested. But not everybody is testing prefilters, not everybody is testing intake filters. There are certain filters that may not require testing. Or filters may be in certain types of service, where it is not clear they are needed;

perhaps they were installed for an older system twenty years ago and they are still in place and still being used, but they are no longer appropriate. Having them in place and testing them does not make a lot of sense. We need to get over that kind of a hurdle. In your particular case, you might want to talk to the folks at Mound, who keep a fairly large stockpile.

WILLIAMS: That is something we will look into. As a matter of fact, I have some contacts up in Mound.

SHERWOOD: They are storing both tested and untested filters for use. They have a large stockpile of both. You might want to get in touch with them to get around some of your time constraints.

WILLIAMS: There is one more thing. At Fernald we are in a very public-sensitive area. If we deviate from the standards, we have no defense from a legal standpoint. That presents a major problem. In our specifications, we are in the process of pointing out the sentence, or the section number and the sentence number, that we need to observe to be in compliance with applicable standards, instead of trying to be in compliance with the whole document. That is where we are now. We prefer not to deviate from standards, because of problems we have had in the past. If you are familiar with Fernald's history, I think you would agree.

NEWTON: I am an aerosol scientist at DOE's Inhalation Toxicology Research Institute. I have a suggestion for people considering new standards. I don't think you have made enough use of the fact that we have radon progeny everywhere. I was struck recently, after I made it to Sandia National Laboratories, that we had one picocurie per liter of radon present in the upstream stack. Downstream of the HEPA filter it was 1.4×10^{-4} the upstream concentration. So, here we have a naturally occurring alpha emitting radionuclide that we can monitor on either side of a HEPA filter and find out when it starts to become degraded, or whether we have a catastrophic failure. That is my suggestion. People should use the presence of radon progeny to monitor the degradation of HEPA filters.

MOKLER: The measurement of radon progeny is an interesting concept as an alternative means for in-place testing of HEPA filters. However, I am not aware of any data comparing this approach to the conventional testing methods. A preliminary study to obtain such data is necessary before the utility, possible advantages, and appropriate situations for application of this approach can be evaluated.

GHOSH: You talked about standardizing the design, but most of the plants have already been designed, they have been installed, and they have been operating all this time. What you are really talking about are standardized testing criteria. Some of the filtering units that you are talking about were built prior to N-509. If you had a section in the N-510 to suggest testing criteria for units built prior to N-509, i.e., non-509 systems, that would be a big help.

JACOX: The first page of all three editions states that N-510 is to be rigorously applied only to systems built to specifications of the same edition of N-509, but it may be used

as technical guidance for all other systems. We have not been successful in getting people to read that. At some DOE sites, even when we point it out, they say, "but the administration says it has to be to the letter". It is the intent of the committee that wrote the standard, that it be used for technical guidance for any system, but rigorously applied only to a system that meets all of the requirements of N-509, same edition. What you suggest is an excellent idea. We have done our best, albeit without much success, to do just that.

GHOSH: If you would take it out and put it in a subsection, and title it for non-509 systems, it would stand out more.

JACOX: It is listed under "Limitations".

ARNDT: I'd like to add to that if I may. There are a lot of word engineers, so that when we use certain words, like "suggest" or "shall", they mean things. When we put a word in like "suggest", you can be assured that there will be people that say that you don't have to do it. And now you can have systems that will not be tested, because of using word like suggest. We do a lot of design reviews and you would be surprised at the type of designs that are sent in by agencies. The only time they may have seen N-509 was when it was included in their design packets. So, there are two ends of the spectrum, the "shall", which people say you have to meet according to the letter of the law, and "suggest", where people say, "well, since you used the term suggest, I don't have to do it." I think we need to come somewhere in the middle, and I really don't know at this point how that could be accomplished other than at the start of the project.

GHOSH: You're right, I agree with what you just mentioned. What I suggest is to include some flexibility: as a minimum, to say that "suggest" means you should do it, whereas "shall" means you have to do it. Flexibility is what we are talking about.

ARNDT: I understand. The point I am trying to make is that we have to be careful with the wording because there are people that will look at "shall" and say you have to follow everything written down whereas "suggest" means you don't have to do it.

MOKLER: To rephrase an important point that Tim Arndt made, we must specify the very general things that must be done. The way you accomplish these ends is where flexibility can come in. We have to remember that just as there is a very strict interpretation of things that you shall do, sometimes the permissiveness of a guidance document is used to avoid doing something.

DU BOIS: Our facility was designed before N-509. We are going through all our tech specs right now. It does not take long to go through the N-509 standard line-item-by-line-item to see if the system meets it and to justify the decision technically. I did it on one of our systems. In eight hours, I was able to go through the entire testing standard to see exactly what the system will meet and to document my technical justification. On the regulatory side, you are going to have further review, but people are willing to work with you. That is my first comment. The second one concerns HEPA filter testing at a qualified vendor facility. I am not against that, but you still need to do an in-place leak test because you have people who put these things in who do not know the fragility of

these filters. We had a case where a HEPA filter system we had just put in, failed. When I discussed it with the particular individuals who were installing it, someone dropped a filter and cracked it. You have to make sure that even though you do pretesting, you do an in-place leak test before you start the system.

MOKLER: For the last thirty years, the in-place test and the filter test facility test have been looked upon as adjuncts to each other. No one that I have been aware of has ever felt that one could stop doing in-place testing if filters were prequalified. You must do both. An important question, however, is the appropriate frequency for in-place testing.

JACOX: I have a question for someone from DOE. At least one DOE facility that I am personally aware of has taken the point of view that N-509 and N-510 must be used to the letter for all systems. Arndt's paper covered this in some detail with the exact phrasing. Although he did not discuss it, I understand that unless something is explicitly discussed and covered in N-509, it cannot be used, even when the document says that other designs that meet the basic criteria can be used; that there is an administrative decision which states that you can not do it. What are the chances that this DOE order can be revised to remedy this situation? I consider current practice to be a gross misinterpretation of the intent of the document that causes severe engineering and cost problems.

ANON: I can't answer that question, but I can get the question to people who can. Ask for an interpretation in writing from EA64, it used to be the old NE group. They just had a change in leadership, and that actually should make things easier. But it is Neil Goldenberg's old organization, safety policy. Put the question to them in writing, state the concern, and they are obligated to respond.

JACOX: To clarify that, did you say you would do that or we should do that?

ANON: You should probably do it, but if you need somebody to facilitate it, I shall.

JACOX: I am sure we will take you up on that.

ANON: I do not have any first hand information on the situation at Hanford. I have heard that they won't let you use anything that is not called out in the standards, such as new methods of testing filters. But I don't know that for a fact. Before I write a letter, I would like to take some people there and take a hard look at their overall testing program, and then make some recommendations.

KOVACH, L.: I looked recently at one of the Hanford designs, and I had a chance to look at the budget also. The system was slightly over ten million dollars. The same system built to N-509 for a power reactor would cost less than one million. In my mind, nine million was for customizing N-509 at Hanford, and that was the reason why the cost went up to ten million dollars. On a cost-benefit basis it is very difficult to justify going away from standardized designs, at least as far as the budget figures that are in the official documents are indicative. I can state with great confidence that they are an order of magnitude higher than anything I have seen for any other "very rigid application" air cleaning systems. In my mind it means that they are not going to be standard systems;

they will be N-509 systems except for something like this or something like that. I am not picking on Hanford for any particular reason, but I have recently looked at more of them than at Savannah River or other sites. My expectation would be that if they standardize, costs should be significantly lower, rather than higher. This puzzles me greatly, and I do not know if anybody else wants to comment.

JACOX: I have spent some weeks at Hanford on initial engineering design discussions for filter systems that will be N-509 systems with some additions because they will include some special process parameters. However, from 50% to 80% of the system will be a basic N-509 designed system. When I learned of the budget figures, I just couldn't believe them, they were incredibly high. And what could easily be done in eighteen months, they were hoping, we were told, to be able to finish by the end of the century. So there is something seriously wrong with the way this project is approached. It is what I would call mindless bureaucracy and politics. There are too many people involved that have to be stroked and satisfied. That is how an eighteen month, million dollar project becomes a six year, forty million dollar project. You end up with the same hardware doing the same thing in the same way. That scares me as a taxpayer, it upsets me as an engineer. I guess it does not upset me too much, because I still take the consulting money. There is something basically wrong when every attempt to standardize and use existing technology, to the extent that it is applicable, ends up with grossly longer schedules and at least an order of magnitude more money.

ARNDT: I would like to say something on that also. Westinghouse has tried to standardize designs on a lot of their projects, and I think you are familiar with one of them. Some of the problems they encountered involve design criteria when they are trying to determine the constituents in tanks and gas streams. It becomes difficult when characterization is unavailable and they have a very difficult time getting access to the tanks. With regard to air cleaning systems, they are trying to standardize how many stages to put on, one, two, or three; should they use charcoal adsorbers; do they need charcoal adsorbers; should they put deentrainers in, etc. I think they are trying to get the right answer, but are not there yet. I know it is the goal, but at times it is very frustrating because the criteria are just not available.

JACOX: I agree that what you say is factual. My feeling is that the concern about characterization is overemphasized. If you assume the worst and then design and build the system for the worst, you will save a tremendous amount of money over the millions and millions of dollars that are being spent on fine detail characterization. At one meeting, we were given limits, and told to use engineering judgement. At another meeting, we were given some limits on some particulate constituents, and a limit for a gaseous chemical constituent that was at least an order of magnitude higher than is physically possible for such a concentration to exist at the assumed temperature and pressure. One of the operational people said, "if we lose that much, my tank's empty in three weeks." So characterization is being approached in ridiculous ways. There may need to be detailed characterization for chemical processing, but for air and gas treatment you can say we may have this much and simply put in a filter. Isn't this better than spending millions of dollars to find out whether or not something is there? You do not have to know exactly what is in a stream to remove it, you merely need to know the range of concentration. When you look at the range of likely concentrations, it

represents a basic reality check. We get so caught up in the bureaucracy that we don't get an opportunity to use good engineering judgement. These were a couple of one week sessions where there were on-site people, people brought in from other DOE facilities, and independent consultants such as myself. I don't know what the meetings cost overall, but just on a couple of very basic points I think that they were more than paid for by the advice given. On one hand, I seem to be saying let's put a component, or a couple components, in to take care of things "just in case," signifying that I don't care about great detail in characterization. On the other hand, I seem to be saying, let's be more careful with the characterization. However, I think they are consistent positions because if we say we are not sure whether a particular species is present, but it is going to cost three million dollars to find out, whereas one or two standard components can handle the species at a cost of a hundred thousand dollars, installing the equipment is a real cost-effective solution.