SESSION 6

INTERNATIONAL PANEL REPORTS ON NUCLEAR AIR AND GAS CLEANING ACTIVITIES FROM AROUND THE WORLD

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PANEL DISCUSSION

INTRODUCTION

WEIDLER: Welcome to the International Panel session. We have a very distinguished panel today. We have Mr. Fukasawa from Hitachi Limited, Mr. Rich Porco from Ellis and Watts, Dr. Ronald Bellamy from the US Nuclear Regulatory Commission. Dr. Juergen Wilhelm, consultant from Germany, Mr. James Slawski, US Department of Energy, Mr. John Dyment, the Atomic Weapons Establishment in the UK, and Dr. Richard Lee from the US Nuclear Regulatory Commission. Each of these gentlemen has something to say, then we will open the floor to questions.

BELLAMY: I have three very brief comments that I would like to make concerning regulatory issues that could be interpreted to have an international flavor. And then Dr. Lee will follow me with some very specific international issues that the regulatory agency is involved in. The first I'd like to mention is an issue that has become of great importance to us over the last year, with our change in chairman. The present chairwoman of the Nuclear Regulatory Commission is a firm believer in verbatim compliance. Whatever the technical specifications or the regulations say, it is the way to do it, and it is the only way to do it. She is not a believer in waivers or exemptions. The present philosophy is that if there is something of such importance that it requires a waiver and exemption, then it must be something that you need to take a look at in the regulation. Maybe the regulation or the actual basis for what you're doing needs to be changed. The second issue has to do with a lot of the work that's been on-going over the past several years with respect to source terms, with respect to changes in the regulatory requirements, and the potential for, I don't want to use the term back-fit, but the potential for modifications to existing filter systems. There's been some discussion on can we remove components, can we remove some HEPA filters, can we remove some activated carbon. I'm not going to stand here and give you any of the answers to those questions, but simply to point it out to you that is an issue that will need to be addressed. And perhaps there's some lessons to be learned from some of the international experience that we will be discussing this afternoon. The third and final issue that I will very briefly mention is the topic of one of the open end papers this afternoon, and that has to do with the criteria for laboratory testing of carbon that has been in-place. The Nuclear Regulatory Commission has, contrary to what I started this brief remarks with, has approved some emergency tech spec changes and waivers over the past several months. And Mr. Lyons will be discussing that issue in great detail this afternoon. So perhaps there is some international experience that we can learn and gain from. And we can use that as we move forward in this area.

LEE: Let me tell you something on the international scene, what the agency is doing, plus the emphasis based on the office of research of the NRC. Since the NRC was formed in 1975, after we split from the AEC, the agency has maintained many bi-lateral agreements with European countries, Asian countries, and most recently the so-called former Eastern European Countries, in cooperative research. And I think there are some areas that will be of interest to the participants of this conference, in the area of aerosol treatment (*i.e.*, before you can treat it you need to know more about the sources and so forth). And I think after the TMI accident in the early 80's, the Office of Research initiated a whole series of bi-lateral agreements with European countries, and Asian countries, in cooperative research and focus on so-called severe accident research. Severe accidents are beyond design-based accidents, and we are dealing in an area where current filters are designed for design base accidents, to handle severe accidents. We know that under severe accident conditions, the aerosol loading on these filters will render them useless. Now, with the revision of the source term, we have not (because the agency is busy addressing other issues) gone back to look at the performance of filters. And I don't know, Ron, whether Region I is looking into it or not. Instead of assuming 95% of gaseous iodine (that filters have to treat), now our new source terms set iodine at 95% aerosol. So this has implications on the operating plants. And as Ron pointed out, the utilities may come in and ask for different things (related to filter performance requirement), and some of the proposals are actually in-house now. So we will be discussing with the Office of Nuclear Reactor Regulation, how to deal with these proposals. Now back to the international arena, under the severe accident agreements, we have been doing a lot of research with Japan, basically with JAERI, the Japan Atomic Energy Research Institute. It started with thermal-hydraulics cooperative research, basically looking at design base loss-of-coolant accidents; now we have extended it into severe accident research. In the severe accident research area, we also have joint agreement with NUPEC, another research organization in Japan, which we deal directly with on hydrogen issues. On hydrogen issues, we are basically dealing with failing the containment very early, very quickly, and not necessarily looking into what the hydrogen burn would do to the aerosols. In Germany, of course, we have a lot of cooperative research agreement with KfK, which now has been renamed as FZK. We also deal with GRS, *etc.* In the late 80's, we started to cooperate with France. That was the first time the agency started to cooperate with France, basically with the CEA (the French Atomic Energy Commission). And I want to point out that there is a lot of activity now going on in France in the source term area (such as aerosol research in the Grenoble research center). The one major project that the agency is tracking now is the PHEBUS-FP project, located in the Cadarache Nuclear Center in the south of France. In '93, they ran the first test, using fresh fuel. In that test, initially the test results showed that 10% of the iodine coming out was gaseous iodine. That caused concern to us, because at that time a Commission paper was pending to revise the source term and we said 5% (gaseous iodine) was the maximum. The preliminary results turned out to be not true, because the initial measurement has error and it is somewhere between two and less than ten percentage gaseous iodine. The next test is going to be run some time this month, actually within a week. And that test is going to be using spent fuel from the BR3 Belgium reactor; fuel is three feet long, and there are about twenty-one rods (one control rod and twenty fuel rods). Of course, if the test doesn't run by July, it will start to conflict with the vacation schedules so it will be postponed until September. I have to tell you that Korea is launching a very ambitious program for the next ten years, spending close to a billion dollars in research to get itself in a position to compete with Japan and the US in future reactors. And the research they started ranges from thermal-hydraulics to severe accidents. So there are a lot of activities going on internationally. I think some of the results from these activities should be of interest to this conference. The agency is also faced with a very important decision, that is on the maintenance of expertise. There's a lot of dialogue now, not just within the US, but with the Europeans, concerning how we can maintain expertise. Another reason we have all these cooperative research agreements is because the budgets are decreasing, so we need to share the research knowledge. And this expertise maintenance is directly related to how we're going to fund, what type of program we will fund in different national laboratories, and what scientists we need to maintain in case there is an accident in a plant, and we need to call upon these people to address the problem. With these remarks, I would like to turn the podium back to the Chairman.

DYMENT: I'm going to try, in the space of 10 minutes to give you a very quick overview of the British Nuclear Industry, where it's come from and where it's going, as a background to the air cleaning problems. In trying to do this I feel a bit like the man on the radio who does a Shakespeare play in 30 seconds.

WORLD SCENE:
This micro-history slide of UK and world nuclear power (from the Nuclear Engineering Handbook, 1995) shows the numbers of reactor units commissioned in first power in various countries during the four decades starting 1956/65. As you see the UK was virtually the sole player in the first decade with around 20 units. In the second decade the rest of the world commissioned over 100 while the UK dropped back to 6. In step with the rest of the world, the UK increased again (second generation reactors) in the 76/85 decade to 10 or so units and dropped back again in the last 10 years.

UK SCENE:
The current UK situation is that 10% of inland energy consumed comes from nuclear power, and 25% of electrical energy generated is nuclear. The generating plant consists of 8 Magnox stations (uranium metal fuel clad in alloy), 7 AGR stations (e/uranium oxide fuel clad in stainless steel), both types with carbon dioxide coolant. Finally, we have 1 PWR station. Reprocessing of these various fuels takes place largely at the Sellafield sites of British Nuclear Fuels. Some reprocessing also takes place at the Dounreay site of AEA. A "drystore" option for the long-term storage of spent fuel has been considered as an alternative to reprocessing.

DECOMMISSIONING:
Various strategies for decommissioning obsolete generating stations are under discussion; the issues centre largely on the (duration of the) delay before dismantling and the safe encapsulation of the installation meanwhile. Decommissioning of redundant nuclear facilities other than power reactors is well advanced within several organizations, *e.g.* decommissioning of the Capenhurst diffusion enrichment plant is complete and the bulk of the metals has been recycled.

WASTE:
Low level nuclear waste is currently disposed of at the Drigg repository, operated by BNFL. Intermediate level waste is currently stored at the sites where it is generated, pending construction of a deep disposal facility by NIREX, the Nuclear Industry Radioactive Waste Executive. The commissioning date for this facility is still some 15 years away. High level waste is currently stored on the site of origin pending vitrification which is in progress.

PROGRESS TOWARDS DISPOSAL:
NIREX is investigating the hydro geological characteristics of a proposed disposal site near Sellafield by means of a "Rock Characterization Facility" (RCF) which is currently being designed. Authority to proceed with construction has not yet been obtained.

NUCLEAR AIR CLEANING:
Many or most UK nuclear air cleaning installations employ HEPA filters. The majority of these use the square deep-pleat format mounted in bag-change housings. There are some plenum chamber mounted installations but they are perceived to present greater problems at changeout and *in situ* testing. Circular (cylindrical) format HEPA filters are now being used to a large extent in new plants. They have 950litre/sec airflow capacity (>2000CFM) and will fit into a standard waste drum. They are also acknowledged to be much more compatible with remote changeout requirements than square format units. In-place or *in situ* testing of HEPA filters is routine at all nuclear sites.

UK NUCLEAR POLICY:
The UK government has published two documents on nuclear policy in the last year, one relating to nuclear power, the other to nuclear waste. The former, the Nuclear Review, had 3 key conclusions:

Firstly, that nuclear power will continue to play a key role in meeting UK energy needs. Secondly, that public sector intervention in the electricity market is unwarranted. Thirdly, that as many UK Nuclear Stations as practical should be moved to the private sector.

Accordingly, the more modern AGR and PWR stations have now joined the fossil fuel generators in the private sector as "British Energy", with only the older Magnox stations remaining in the public sector as "Magnox Electric".

The key findings of the second policy statement, the Waste Management Review, were as follows:

1. Deep disposal of ILW continues to be Government policy; Nirex should implement plans for the repository without delay.
2. Deep disposal of vitrified HLW is a favored option.
3. A range of potentially acceptable decommissioning strategies is recognised, including "Safestore" concepts.
4. In general, radioactive wastes should not be imported/exported to/from the UK.
5. Waste substitution is an acceptable option provided there is environmental neutrality for the UK.

WEIDLER: Our next speaker Richard Porco from Ellis & Watts, Richard is going to talk about developments in China and Korea.

PORCO: One of the questions that I am asked very often is why do we, on the ASME code committees, work so diligently to develop standards, when in the US we're not working on any new nuclear power plants. We put a lot of effort into our work, and other than the DOE, commercial power plants are mainly working on retrofits or upgrades. The amount of work that goes into the codes and standards seems phenomenal to support that effort. Why we work on the codes that diligently and what we're supporting is a very vibrant commercial nuclear power industry in the Orient. I think most of you are aware of Korea's aggressive nuclear program. The key to Korea, China, and other emerging countries is to develop an infrastructure to support the rapid growth necessary. Parts of that infrastructure would be would be communications, another is the road systems. The main part is energy. This is a slide of Korea's operating plants. They currently have eleven operating plants that generate more than 9,100 megawatts. The first unit Kori Unit was brought online for commercial operation in 1978, and over the period of the next sixteen years, KEPCO brought on ten more reactors with the last one, YGN Unit 4, coming online this year. KEPCO also plans on bringing another nine reactors online within the next seven years. At least 6 more are planned, including a reactor for North Korea. This pace seems phenomenal compared to the pace the U.S. built reactors in the 70's and 80's. Korea is actually supporting this effort, and it has helped their economy grow quite rapidly. Other countries that are looking at this rapid growth and trying to imitate Korea are Turkey, Thailand, India, and Pakistan. Japan has always had an aggressive nuclear program, and I think Dr. Fukasawa will also talk about Japan.

I'm going to discuss nuclear energy in the People's Republic of China. Since the 1970's China started to talk to the world about its civilian nuclear power applications. So far, China has three reactors. The 300MWe indigenous pressure water reactor at Quinshan and the two 950MWe French PWRs at Guangdong near Daya Bay supply less than 1% of China's electricity. The successful entry of the three reactors into commercial service in 1994 has stimulated a sense of confidence in nuclear power within China. China's gross national product has increased more than 400% since 1980. Shortages of electricity estimated to average around 20% are blamed on China's new industrial enterprises operating below their potential capacity. To achieve GNP annual growth at the projected rate of 7-10% per year for the rest of the 1990's and the first decade of the twenty-first century, the increase in the electrical production will be required. Right now there are four additional plants under construction in China. Quinshan Units 2 and 3 are under construction and construction of two more plants at Quangdong, LINGAO Units 1 and 2, has begun. In addition, reactors are planned for Quinshan Units 4 and 5, these are Canadian CANDU 6 reactors. And two more at Wufangding, and these are PWR's. They are Russian UVER-type under an agreement with the St. Petersburg Atomic Energy Development Company. Korea has also entered into agreements with the China National Nuclear Corporation, and they are working on what they consider the Korean standardized nuclear power plant, which is similar to Bechtel's Standard Nuclear Unit Power Plant (SNUPPS) and other standardized nuclear power plants we had in the 80's. The Korean standardized plant is based on UGN 3 and 4 and ULCHIN 3 and 4 plants. Proposed sites are Shangdong and Fujian Provinces. Each site is different enough to affect the design of most of the equipment. The same thing will be true when they are adapted for the China market. In addition, there are seven additional sites under consideration. The whole area along the coast of China is looking to support and finance a nuclear reactor in their Province. There is a possibility for thirty to forty reactors. The problem here is obviously financing. Even if China achieves 50% of its projections, it would still be a major accomplishment. The purpose of showing you all this is that there is a commercial nuclear market out there. And there is also a major need for our codes, standards, developments and equipment.

WEIDLER: Thank you Mr. Porco. Our next speaker will be Dr. Wilhelm.

Provisions for Containment Venting in Germany.

J.G. Wilhelm, Consultant

Abstract.

In this short paper an overlook is given of the systems developed in Germany for filtered containment venting and their implementation in nuclear power plants. More information on the development can be found in the Poceedings of the DOE/NRC Aircleaning Conferences (1, 2, 3)

In Germany, 28.8 % of the electric energy is produced by 19 nuclear power reactors. No new power reactor is expected to be built at least within the next ten years, but France and Germany cooperate in the development of a future European Power Reactor (ERP). This reactor type will be fitted with a core catcher and passive cooling in order to avoid serious consequences of a hypothetical core meltdown accident so that provisions for containment venting are not required.

In May 1990, the German Reactor Safety Commission specified the requirements on removal systems for filtered containment venting. Some data for LWRs are given in Tab. 1.

Reactor Type	PWR	BWR
Total mass of particles to be removed (kg) (including a safety factor of 50 %)	60	30
Decay heat (kW) Aerosols Gaseous iodine	 2 5	 180 7
Content of steam in off-gas (%)	< 100	<100
Droplet aerosol by condensation (g/m^3) *	< 5	< 5
Beginning of venting after core meltdown	2 -3 d	> 4 h
End of containment venting	7 d	7d
Removal efficiency (%) Aerosols Iodine, elemental Iodine, organic	 ≥ 99,9 ≥ 90,0 0,0	 ≥ 99,9 ≥ 90,0 0,0

* in tubes, fittings and containment

Tab. 1 Requirements and conditions for filtered containment venting in Germany

Backfitting measures allowing filtered containment venting have already been taken in the exsisting German power reactors. For the removal of droplets, mist and particles in the µm and submicrometer ranges, filter units were developed on the basis of packs of metal fiber fleeces with decreasing fiber diameters. These filter units were designed on the basis of experience first gained in droplet and mist removal with a metal fiber droplet separator of extremely high efficiency, to be installed upstream of HEPA filters of conventional design. When the factory producing the fiber fleeces from a special stainless steel was able to reduce the fiber diameter down to 2 µm, the target of the original development was extended to build a droplet-, mist- and particle filter unit, completely made from stainless steel. The tests with aerosols of droplets, mist and particles showed that removal efficiencies > 99,99 % could be reached by the proper selection of the fiber diameters and the depth and arrangement of the different fleeces. Also it could be demonstrated that, even under extreme droplet and mist loading of the atmosphere to be filtered, no water reached the final section of the filter unit provided to remove dry aerosol particles with diameters in the submicron range.The design of the combined metal filter units allows to transfer the mechanical strength from the fiber media to perforated sheet metal or heavy wire mesh. Organic material is not used. In this way, the problems connected to the decreasing tensile strength of the HEPA filter media due to pleating and effects of wetting and heating, primarily challenging the organic binder of the media, could be avoided.

Filter units of the metal fiber type described were built to clean up the containment venting off-gas both by dry and wet filter methods. The "dry filter method" has been developed in two versions, named the Krantz/RWE system and the Krantz/KfK system. The Krantz/RWE system is shown in Fig. 1. The filter unit for aerosols is installed inside the containment and upstream of the pressur relief trottling valve for the off-gas. The dimensions of a typical module are given in Fig. 2 which includes also data on the required and proved performance. The loading capacity for particle aerosols is tested with a plama torch generated tin dioxide of 0.5 µm MMD. Uranine is used for the final test of the removal efficiency of each unit fabricatet. The decontamination factors are normally above 10,000. The expected diameters of particles, airborne in a PWR containment atmosphere at the start of filtered venting, are much larger when calculated with the NAUA-Code. In terms of the removal efficiency and pressure drop of the filter unit, the test aerosols are much harder to trap.

In Fig. 3 the dimensions and data are given for an iodine sorption filter module. The iodine sorbens is a zeolite, used in form of ball shaped granules with diameters between 1 and 3.5 mm. To prevent potential catalytic reactions between hydrogen and oxygen on the surface of the sorbens , an binary doped zeolite named Baylith ID 625 is used. The iodine is trapped mainly in the form of silver iodide. The iodine filter module is situated in the auxilary building behind the pressure relief throttling valve. The isenthopic expansion of the vented hot gas-steam mixture on the pressure relief valve down to nearly atmospheric pressure will result in a dry off-gas, containing overheated steam. During the first operational period of the originally cool iodine filter, condensation is avoided by the heat of adsorption of steam on the dry zeolite sorbens.Three German PWRs are fitted with the filter systems shown in Fig. 1.

In Fig. 4 the Krantz/KfK dry filter system for the filtered containment venting is represented. In this version of the dry filter method, the droplet separator and aerosol filter modules are combined with the iodine filter modules and the whole filter unit is arranged in the auxiliary building downstream of the pressure relief valve. The dimensions and the required and proved data of a filter unit, built for a volumetric flow rate of 18,000 m_n^3/h, are given in Fig. 5. Again, three German PWRs are equipped with this dry filter system. The avantages of both dry filter systems are mainly a result of the exclusive use of passive components. Emergency power and the supply of cooling water and chemical additives are not needed and an extremely high stability at different temperatures and radiation levels can be achieved

Also a "wet filter method" to clean the vented off-gas during a core meltdown accident was developed in Germany. This removal system includes a Venturi scrubber and a metal fiber droplet-, mist- and particle filter unit, in principle the same as mentioned before. The Venturi nozzels, scrubbing solution and the filter unit are inside of a pressure vessel. Because the scrubber is arranged upstream of the pressure relief valve (Fig. 6), it is working at a pressure near the containment pressure. During venting, the scrubber is operating in a sliding pressure mode. A large exchange area of the scrubbing solution, sucked into the throats of the Venturi nozzels, is generatet by a very high difference of the velocity between the vented gas-steam mixture and the fine droplets of the entrained scrubbing solution. Another scrubber version can be operated close to atmospheric pressure and was developed for containments with a low design pressure. To remove iodine, the scrubbing solution contains sodium hydroxide and sodium thiosulfate. To reach a high removal efficiency for organic iodine, a dry iodine filter can be integrated in the final assembly. Removal efficiencies for aerosols of > 99.95 % and > 99 % for elemental iodine have been published (3). Thirteen nuclear power reactors in Germany are already equipped with the scrubber-filter system.

The Multiway Sorption Filter is a shaft type filter housing built to pass the exhaust air stream to be cleaned two times through the same sorption material, saving up to around 50 % of the material needed to operate with a high decontamination factor during a long time of operation. It was originally developed for radioiodine removal. The activated carbon, contained in the lower part of the filter housing and previously used as long as possible for iodine removal in the upper part of the housing, is still good enough for pre-adsorption of air pollutants. The construction of this counter current filter guarantees an exact bed depth and stay time. It is now widely used in German power reaktor stations and, as a fall out of a nuclear development, in the conventional industry. In a radioactive waste burning plant, the MWS filter is used in the off gas system to reduce the dioxine to less than 0.5 nanogram per cubicmeter. No change of the charcoal layer was necessary during an operation period of more then three years.

References:

(1) H.-G.Dillmann, J.G. Wilhelm, "Investigations into the design of a filter system for PWR containment venting", CONF-900813, Vol. 2, p. 898 (1990).

(2) H.-G. Dillmann, H. Pasler, J.G. Wilhelm, "Off-gas cleaning devieces for containment venting", CONF-880820, Vol. 2, p. 709 (1988).

(3) B. Eckardt," Containment venting sliding pressure venting process for PWR and BWR plants - process design and test results", CONF-900813, Vol. 2, p. 876 (1990)

Filtered Containment Venting

The Dry Filter Method

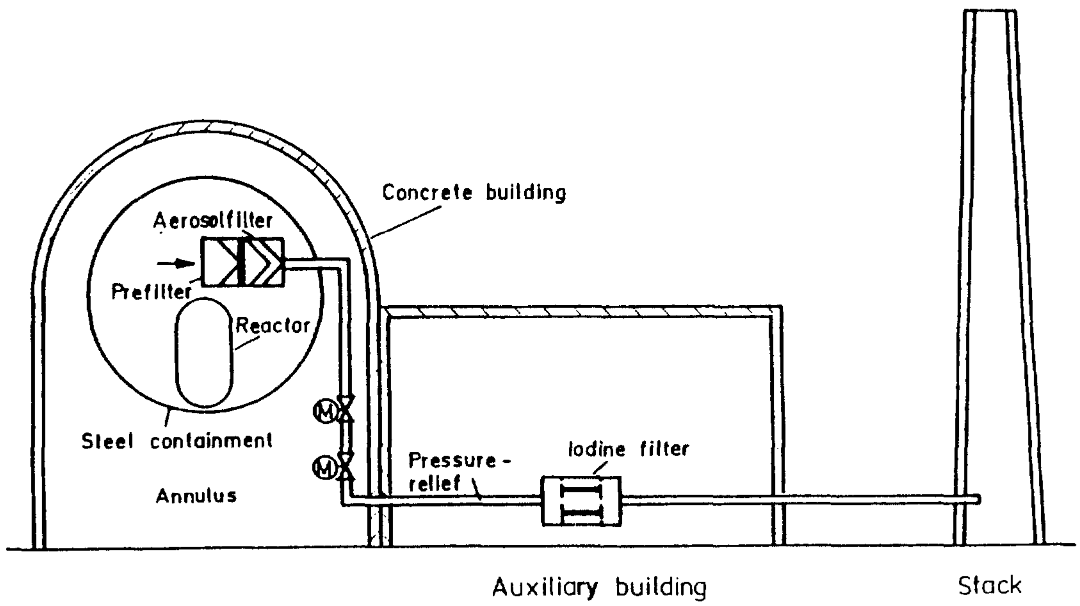
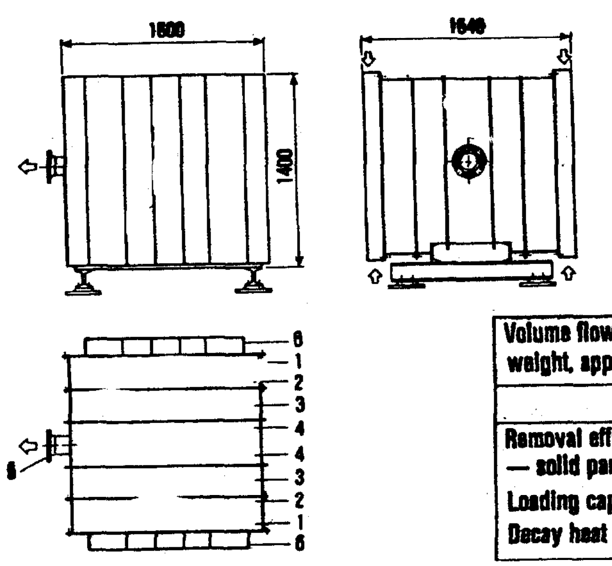


Fig. 1 The Krantz/RWE System

Metal fiber filter module



Legend

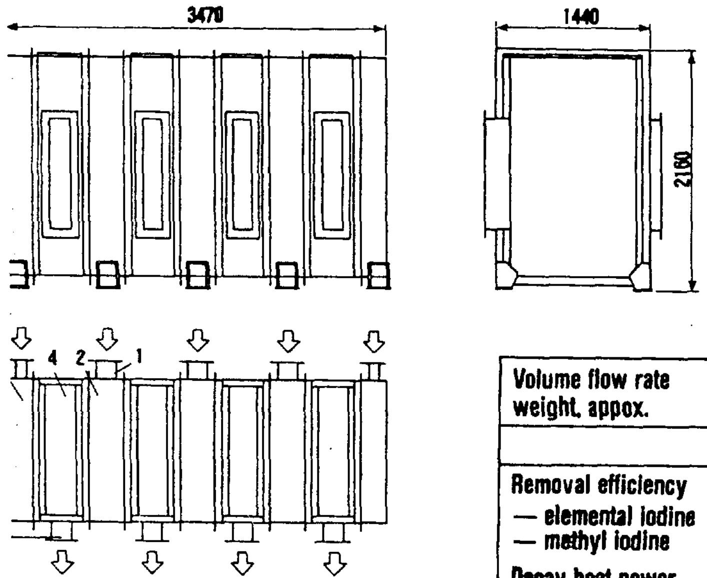
1 Droplet separator
2,3 Prefilter
4 Finefilter
5 Exhaust pipe
6 Inlet

Volume flow rate	m_n^3/h	9333	
weight, appox.	kg	2000	
		Required	Proved
Removal efficiency — solid particle	%	99.9	99.99
Loading capacity, SnO_2	kg	60	80
Decay heat power	kw	2	20

Fig. 2

Filtered Containment Venting

The Dry Filter Method



Legend

1 Feed pipe
2,3 Inlet chamber
4 Iodine filter
5 Exhaust pipe

Volume flow rate weight, appox.	m_n^3/h kg	28000 8200	
		Required	Proved
Removal efficiency — elemental iodine — methyl iodine	 % %	 90.0 0.0	 99.97 97.40
Decay heat power	kw	5	10

Fig. 3 Iodine sorption filter module

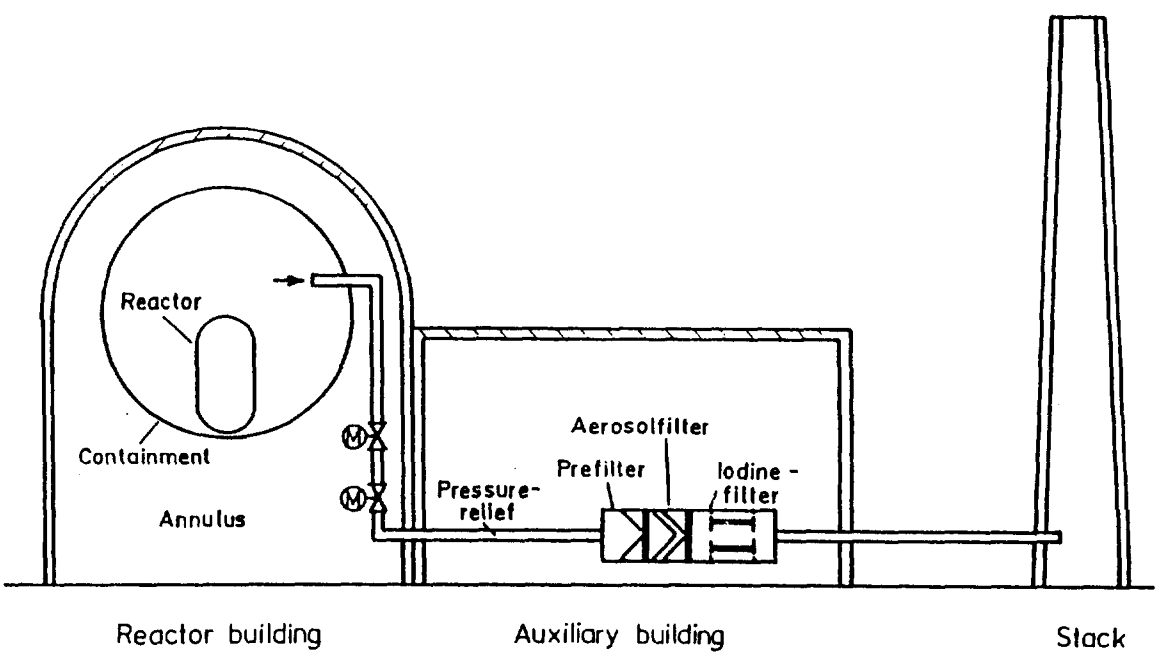
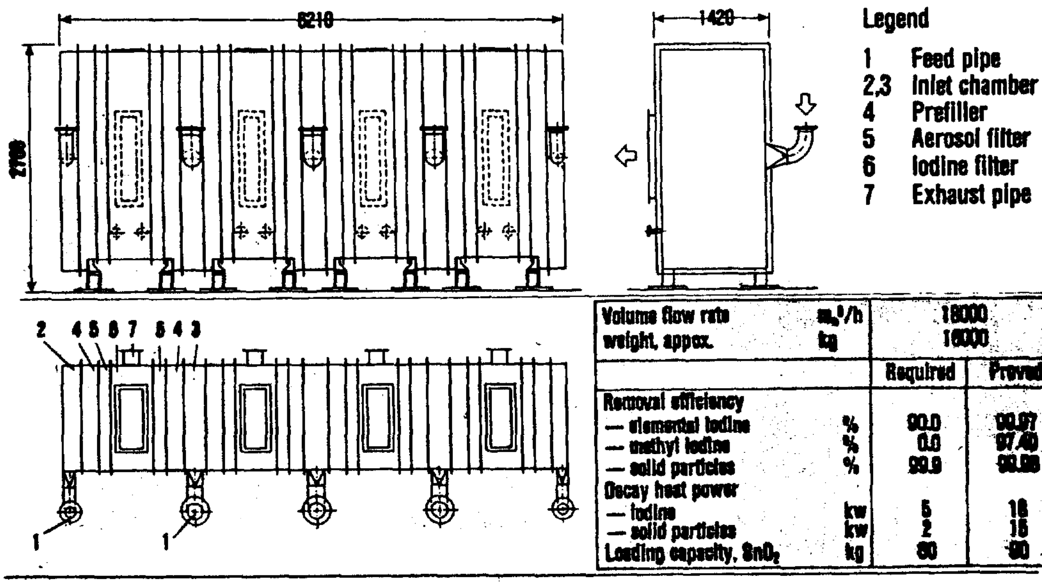


Fig. 4 The Krantz/KfK System

Filtered Contaiment Venting

The Dry Filter Method

Combined metal fiber and zeolite iodine filter module



Volume flow rate	m_n^3/h	18000	
weight, appox.	kg	16000	
		Required	Proved
Removal efficiency			
— elemental iodine	%	90.0	99.97
— methyl iodine	%	0.0	97.40
— solid particles	%	99.9	99.98
Decay heat power			
— iodine	kw	5	16
— solid particles	kw	2	15
Loading capacity, SnO_2	kg	80	90

Fig. 5

The Wet Sliding Pressure Venting Process

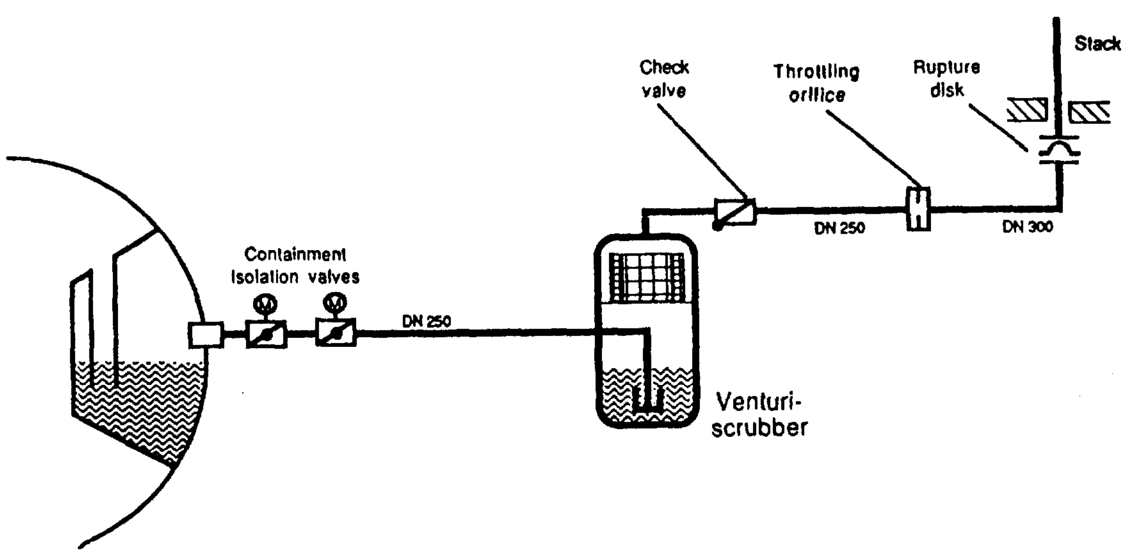


Fig. 6 Flow Diagram of One Version by Siemens

FUKASAWA: The title of my talk is the present status of the Japanese nuclear industry. This includes off-gas treatment activities, but is mainly about nuclear power generation on these items written here. This figure shows you the capacity and operation data for nuclear power units in the world, on which I would like to show you Japan's nuclear position in the world. For plant capacity, Japan is in the third position in the world. These data I explain here are nuclear electricity share and average capacity factor. For both data, Japan is in the thirteenth position in the world. For plant capacity factor, Japan exhibited 80.2% in fiscal year 1995, excluding 18.3% periodical inspection stop. So 1.5%, or 0.3 events per unit per year, is unplanned outage frequency, which I think the smallest value in the world. This figure shows nuclear power plants in Japan. Fifty operation units include 26 BWR's in green color, twenty-two PWR's in blue color, and one gas cooled reactor in Tokai-one unit, and one prototype ATR, Fugen here. Among 4 nuclear units under construction there is one prototype FBR, Monju here, and 2 advanced BWR's here, Kashiwazaki-Kariwa-6 and 7 units. Two units are on order, and an additional fourteen units are being considered now. Fuel cycle facilities are operated or under construction at the very northern part of Japan's main island Honshu. The facilities are centrifugal uranium enrichment, Purex reprocessing, low-level waste shallow disposal, and high level vitrified waste storage. I will show you briefly the status of the Fugen, Monju, advanced BWR's, GCR, and fuel cycle facilities. This is the Japanese prototype advanced thermal reactor Fugen of PNC, which has U or MOX fuel, a heavy water moderator and the light water coolant. I think ATR is useful for Pu consumption before FBR, but no further ATR development was decided last August. Hitachi was one of the main contractors of ATR, so I was so sad to hear this news. This is the Japanese prototype fast breeder reactor Monju. Because of the lack of energy resources, Japan is proceeding FBR project. Monju achieved initial criticality in April 1995. But six months later a leak of non-radioactive sodium occurred. The leak portion was just part of the secondary loop. The leak portion is here, and the missing part was found at the bottom of the super heater. The sodium leak occurred exactly on December 8, 1995. I cited these figures from Nuclear News. The leak position was about one meter from the concrete wall of the containment vessel room. The leaked sodium amount was seven hundred kilograms, and four hundred fifty kilograms have been recovered by now, two hundred kilograms were dispersed to the environment, and twenty kilograms are still in the ducts. Sodium flow vibration and repeated thermal stress broke the thermocouple tube and caused the sodium leakage. This missing part was found in this distributor at the bottom of the super heater. Now the public concern is focused on this subject. I hope Japan can continue the FBR development program. The is the world's first advanced BWR's Kashiwazaki-Kariwa-6 and 7 units. The schedule is shown here. This month, the first one will become full power and this winter commercial operation. The characteristics of ABR are the internal pump, the fine motion control rod drive, and the reinforced concrete primary containment vessel. This is the joint venture of General Electric, Toshiba and Hitachi companies. The decommissioning program for nuclear reactors is also proceeding in Japan. For Japan power demonstration reactor of JAERI, the decommissioning was finished this March after testing such a device for remote removal of in core components. For the first commercial reactor, Tokai-1 of JAPCO, Japan Atomic Power Company, the decommissioning was decided last month. Among a hundred and sixty thousand tons of generated waste, they think eighty-five percent can be treated as non-radioactive. This figure shows the progress in fuel cycle facilities. The uranium enrichment plant started operation in 1992. Final capacity will be fifteen hundred tons SWU per year. The low level waste disposal center started operation in 1992. Final capacity will be three million drums disposal. One drum is two hundred liters or fifty-five gallons. The high level waste management center started operation in 1995. Final capacity will be three thousand canisters storage. The reprocessing plant will start operation in 2003. Final capacity will be three thousand tons heavy metal for spent fuel pool and eight hundred tons of heavy metal per year for the reprocessing. I show you two R&D activities in the field of nuclear fuel cycle. The partitioning and transmutation program aims at reducing toxicity of high level waste by recovering long-lived nuclides and converting them into short-lived nuclides. We call this the Omega Project which has been done for about ten years now. PNC presented the actinides recycle program two years ago. The concept of actinides recycle is described here which aims at the effective use of minor actinides such as neptunium, americium, and curium in the future FBR cycle. Finally, I will explain the systems and recent activities for off-gas treatment in Japan. For nuclear power plants, the United States is our teacher. We are also looking for the leak test method without using Freon for standby gas treatment system. Source term evaluation is also being done with non-volatile cesium iodide. For reprocessing plants, the Rokkasho processing plant will adopt German silver adsorbent of iodine removal. In this case, Germany is our teacher. For the recycle equipment test facility for FBR fuel reprocessing of PNC, they will also adopt silver adsorbent. Tokai reprocessing plant now in operation removes iodine by the alkaline scrubbing method, and is now considering the iodine removal from the solution by silver precipitate. Crypton evolved removal is also being considered by PNC. For enrichment and fabrication plants, uranium recovery from HEPA is considered by vibration and acid leach methods.

WEIDLER: Thank you Mr. Fukasawa. Our next speaker is James Slawski from US Department of Energy and then we will open the floor to questions.

SLAWSKI: I think I need to say that anything I say at this meeting is my thoughts and I do not speak officially for the Department of Energy. That should cover what Ron said earlier this week in so many words. I have been focusing my work in this area on standards, picking up some old DOE standards and revising them and now working with ASME, the CONAGT Committee on working on their standards, specifically the one on HEPA filters. We are proceeding at this time with the resolution of the DOE draft standard for specifications. We have redlined strike out or revision one of the draft that we put out last year. After our meeting earlier this week we will be doing revision two of that. From that time we will be going through on a line by line comparison between that and the FC Section of AG-1. I am quite aware that there is a Federal Law that where it is practicable we adopt a non-government standard and I am working to head in that direction for the department. At this time, I'm aware that the Department of Energy does not have a driver, it does not have a mandatory requirement on filters. We seem to be operating on inertia based on work that people like Humphrey Gilbert started years ago. We are talking about having a shell statement which could be a DOE order, a policy statement. We could get something added in to 10CFR830, the Quality Assurance Rule. Other considerations are 10CFR834, Radiological Protection for the Public, and 10CFR835, Radiological Protection for Occupational Safety and Health. These are just things that we are considering at this point. We are aware also that we need a technical basis for maximum life of filters and we are concerned about those factors that I hear from people in this meeting. Our interest, we have radiological as well as non-radiological concerns in this area. On the radiological side, the overwhelming driver, my understanding is, the binder on the media as it's exposed to radiation. We also have other organic compounds, the plywood and the box itself, the glues that hold the plys together, the glues that hold the filter pack to the case and then the seal to the edge of the case, the gasket. We are looking for a technical basis to evaluate those for the life expectancy or maximum life that we might derive. Rocky Flats has been funded to do some studies on aging and we are very interested to see the outcomes of that. We are finally we are working on getting out the draft for the air cleaning handbook, and our target is to get that out for review by the end of this calendar year. And Werner Bergman is getting optimistic that will happen. Those are my comments at this point.

DISCUSSION

WEIDLER: Thank you very much. Now I open the floor to questions.

FIRST: I do not want to sound repetitive, I asked this same question this morning, but what is the panel's view of the of prospects for international standards with regard to nuclear air and gas cleaning, particularly, and other aspects of nuclear constructions in general?

PORCO: I can only speak from certain countries but Korea has adopted the ASME codes and ASME AG-1 in a requirement in their equipment specifications. China has adopted them on certain projects, very cautiously. In other words they will invoke codes and standards and then depending on how much money they really cost they may reduce the qualification requirements. Taiwan has adopted the ASME requirements. The proposed plants in Thailand and Turkey have either ASME requirements or Canadian standards which are, in my opinion, based on the ASME standards. Some of the other panel members may want to comment.

WILHELM: Well in Europe, we have the Eurotome and Eurotome is in charge of all the regulations that should be the same. It is not at the moment with respect to filter testing also, but it continues to unify Europe with respect to health physics with respect to radioactive material or not. I see a good future for a generation over Europe because as I told before France and Germany together developed a pressurized reactor. And if you start this way you will also unify your air cleaning systems, and what you ask for the air cleaning system. At the moment it is not the case. At the moment Germany has its own regulation, France has its own regulation, too.

DYMENT: Looking at what has happened in the past on standards in filter testing, one can look for example at the ASHRAE standard which started out as 52-68. Over the years it has gradually become adopted very widely, and two or three years ago it was accepted as a European standard. So it seems that if a standard works and continues to be accepted, it will become more widely used. Eventually it may become *de facto* an international standard. I think that for nuclear structures and testing procedures, it could be that the regulatory frameworks in different parts of the world would require differing standards to be applied. I think therefore that it would be difficult for standard documents from one country to be applicable in another without modification or adaptation. Looking at what we were discussing this morning on *in situ* testing standards, in the UK our *in situ* procedures are not national standards. Various organizations and sites have developed their own procedures for these tasks; they may ultimately come together as a national standard or more likely as a European standard. Whether it would grow from there to be an ISO standard remains to be seen, but it is going to be a long term process and we can just wait and see.

FUKASAWA: As I said to you, Japan deferred US standard for orchestratement in nuclear facilities. But in general I think Japan's rule is more severe because, for example, Japan has many earthquakes, small , large and so on.

WEIDLER: As you can see, Dr. First, that is a difficult question to answer. Not impossible, but it will take a lot of work in the years ahead.

RICKETTS: I wonder if I might change the topic of conversation a little bit. I'd like to address several questions to representatives of the NRC, either Dr. Bellamy or Dr. Lee, or whomever else might be able to answer. I'm asking in the context of using regulatory guidelines to drive changes in component performance standards that would be documented in the form of codes and standards, in particular, HEPA filters. And I'm wondering what timetable the NRC has for updating, revising and releasing their regulatory guidelines. I'm thinking in terms of Regulatory Guides 1.52, 1.14, and maybe 1.76.

BELLAMY: To be very honest with you, I had hoped beyond my wildest dreams that question would not come up at this conference. I have no clue as to when, or even if, the agency will be revising Reg. Guide 1.52. I would hazard to say that it's not even on the active working list as far as I'm aware of. So I think the direct answer to your question is we're not working on it and not in the near future. That was the second part of your comment. My personal opinion on the first part of your comment would be that I wouldn't look to the regulatory agencies to drive what the criteria should be for the components. I would turn that around and I would say that the ASME committee, other industry groups, such as NHUG, should be coming up with those criteria, and then coming to us and saying here is the industry consensus, here is what we think is appropriate. Since we are working actively on those committees and on those groups we should then say yeah, verily, and endorse it. I would turn the first part around that way and throw the onus back on the industry as a whole. I am speaking for four people, anybody disagree or have any....unless Dr. Lee knows something else about revising Reg. Guide 1.52, I don't believe that's on our agenda.

WEIDLER: I would just have one comment, Dr. Bellamy. I would love to see the NRC review and adopt AG-1. Is there any plan in that future?

BELLAMY: Not that I am aware of. My understanding of the situation is that we would take a look at specific sections of that and if the need arose we would endorse them in individual regulatory guides. But again, we're discussing an area that does not have a very high priority right now with the agency. Jim Lyons, please...bail me out.

LYONS: With respect to AG-1, in the improved standard Tech. Specs., it is one of the options that you can use to reference it, instead of other standards. So, in a sense, the staff, by issuing the improved standard Tech. Specs. says this is an option, it's something that we would accept.

RICKETTS: I wonder if I could follow up a little bit. Doesn't the NRC essentially in the end carry the ultimate responsibility for the public health and safety with regard to nuclear facilities? In that respect, don't they really need to take the lead on something like this in their guidelines?

BELLAMY: Obviously the answer to your first question is yes, our charter is to protect public health and safety. But I think before I would be comfortable in recommending to our management that we take that step of generating any new criteria or revised criteria, I think we first have to make the case that what we now have out there is not adequate to protect public health and safety. And I know that I would not be able to justify such a statement at this present time. When the Atomic Energy Commission was split back in 1975, the purpose of that split was very clearly to separate the promotion arm of the nuclear industry from the regulatory arm of the nuclear industry. And I personally would have a difficult time somewhat justifying why the generation of new components, so to speak, would not be more in the lines of promotion of nuclear power. And therefore I would probably try to turn your question around to let the Department of Energy address it.

RICKETTS: While we have you up there, I wonder if you could address one last question. Could you clarify the relationship between NRC and DOE regarding whether DOE is subject to NRC guidelines as far as facility operation goes?

BELLAMY: Jim, I think you are probably better to address that than I am. I could answer it but, please, try first.

SLAWSKI: I am not sure I know the answer to that because it is really far outside my turf.

BELLAMY: Then I guess my answer to that would be, I am not aware that the Department of Energy takes the NRC criteria, regulations, regulatory guides, standard view plans, whatever, and implements them on a one-to-one basis. My experience has been that they take the criteria and they use whatever they think is appropriate. When it fits it fits, and when it doesn't, it doesn't.

HAYES: I am aware that at the present time I believe we have two resident inspectors, one at the Portsmouth facility and one at the Paducah facility. I don't know exactly how that originated but it's my understanding that we do have some people there. It is similar to having resident inspectors at power plants. And I also know that there has been under discussion in the Congress the question of having the NRC oversee certain activities at DOE facilities, but that is still in the formative stages at this point.

BELLAMY: Jack is correct, there are four residents at the two GDP facilities. When these resident inspectors come up with findings or violations, there is a major discussion going on now as to exactly what they would be called and how the Department of Energy addresses them.

ANON: Did you say Portsmouth and Paducah? Aren't those United States Enrichment Corporation facilities?

BELLAMY: That is correct.

KOVACH: I always like to come to these meetings and try to explain to DOE and NRC what they are really doing. We do not have enough time to explain to them what is it that they should be doing, because that takes a long time and they will not listen. Again, US Enrichment Corporation is in the process of privatization. The DOE philosophy and the DOE interagency agreement is that privatized facilities will be phased over to NRC for regulation. I think I mentioned it in my ramblings the first day that the tank waste remediation system privatization initiative, that John Wagoner talked about also, is, except for the early demonstration phase 1A, proposed to be under NRC regulation and not DOE regulation. In the meantime DOE will be in charge of only radiological safety regulation. All other regulations will be turned over in the privatized sites to OSHA, Ecology, or Department of Health, as an example, in Washington, just like any other private organization. So that is the reason why you start seeing NRC residents at some of the facilities. There is an interagency group composed of NRC Headquarters, DOE headquarters, and some of the DOE site operations offices, trying to streamline the phase-in of the new NRC regulations. That is also the reason for some of the discrepancies as to who is doing what. As far as revisions of regulatory guides or making changes in the regulatory guides, I think it was pointed out several times in the past, that there are mistakes in them. Basically, they are unenforceable as they are, and really, if the Chairman of the Nuclear Regulatory Commission is interested in a verbatim enforcement of everybody who claimed Regulatory Guide 1.52 compliance she would probably have to shut down half of the operating nuclear power plants immediately. So we still have discretionary enforcement of some of the regulations. I am greatly troubled, though, when both in public meetings and in an open forum, like the conference here, or in not closed meetings, but open to the public in discussions with NRC personnel, you hear statements, "well, yes this is technically indefensible but this is what we are doing." I think once we get to this point the technical basis of this whole industry is going down hill real fast. This is an area where I feel we definitely have to change. As far as international cooperation, I think in some areas in standardization it will be difficult, in some areas not so difficult. A few years ago we had an OECD group that started to recommend common standards, at least common test conditions, for testing iodine adsorbents (temperature, humidity and so on). I think most European countries went along with the recommendations. In the US, however, we still have about fifteen different test conditions and that's just on Tuesdays; on Wednesdays we have a few more. And some of these are realistic and some of them have absolutely nothing to do with reality. When we are talking about international standardization it also means that we have to give up some of our stupid US standards here, and accept some of the foreign ones that are good, and vice versa. You do not realize how difficult it is until you start supplying the same material to different countries, and you look at the test methodologies and it's relatively easy to find that one of them is really, really good and easy to consistently perform, you don't need two lawyers to interpret it, you don't need a lawyer for yourself and one for the regulatory agency. It's clearly written, it's readable and that's the one that really should be adopted, instead of everybody trying to come up with a slightly different one, often without understanding the basic technical concepts on which the particular test procedure is based. So this is just a little additional rambling relating to standards and how we are interpreting some of the wording of these standards and codes. And I hope you forgive me for the repetition that you heard in some areas.

CAMPBELL: I would like to know if other countries have documents similar to the DOE Air Cleaning Handbook? And if they do, would it be possible to get copies?

DYMENT: We do not have an Air Cleaning Handbook. We have spent quite a lot of time looking at your Air Cleaning Handbook. We do have various other documentation, though. In particular we have a nuclear industry purchasing specification for HEPA filters, which was arrived at after a consensus over many years. And there are various other documents as I've said earlier, which taken together would form the seeds of a handbook but that process has not yet occurred.

PORCO: In China and also in Korea you will find the DOE Air Cleaning Handbook.

CAMPBELL: What I hear is that, there is no equivalent to the DOE Air Cleaning Handbook anywhere else, from what we know?

PORCO: They are currently using the DOE handbook as a reference, and as you know it is out of date and is being revised.

WEIDLER: A quick summary. I would say that what we heard in our tour of the nuclear world for this afternoon is that we have a lot of pleas for international standards, that we have a plea for redeveloping our technical expertise, at least in the United States, and that we have a lot of concern for the regulations. The one on the standards I will convey to the Board of the Nuclear Codes and Standards and I know they are interested in this subject. I want to thank this panel, we've enjoyed it.