KEYNOTE ADDRESS

Introduction of Thomas Kress, Keynote Speaker

FIRST: Dr. Kress has recentiy been appointed to the very important post of Chairman of the Nuclear Regulatory Commission's Advisory Committee for Reactor Safeguards. This committee, as many of you know, was created by a congressional statute at the very beginning of the government's nuclear program after World War II. It has continued, uninterrupted as a very important committee that assists the NRC with technical advice on all aspects of nuclear safety. One of the topics, of course, is air and gas cleaning technology. Dr. Kress has been involved in this technical area for many years. Before his appointment to the Advisory Committee for Reactor Safeguards he worked for thirty-five years at Oak Ridge National Laboratory in various posts concerned with areas of nuclear safety. He managed the NRC's research program at Oak Ridge in the area of source terms and nuclear aerosol behavior. His education included a number of different schools, but he received his doctorate in engineering sciences at the University of Tennessee. I've known Tom for many years, served on advisory panels with him, and it has been a sheer delight for me to have had him respond positively to the program committee's invitation to give this keynote address. The title of his talk is "Nuclear Aerosols: Unfinished Business".

NUCLEAR AEROSOLS: UNFINISHED BUSINESS

T. S. Kress

Talk presented to the 24th Nuclear Air Cleaning Conference*
July 15, 1996
Portland, Oregon

I am delighted to be here to give the keynote address to this the 24th meeting of the Nuclear Air Cleaning Conference - a conference that I well respect. I have attended several of these in the past but I haven't been active recently. That is because the extent of my technical involvement in nuclear air cleaning over the past 5 years has been to argue with fellow ACRS members as to which is most important to reactor safety - thermal hydraulics or aerosol behavior. I am not sure who is winning the ongoing argument.

I think you can even correlate being asked to be a keynote speaker as being a pretty good sign that you may be near the end of your useful technical life. When asked if I would make this presentation, my first thought was why, couldn't the 1st, 2nd, 3rd, 4th, and 5th choices make it?

I understand the focus of this conference is on "nuclear air and waste treatment technology and its relationship to nuclear safety". If I interpret that in a broad sense to include aerosol behavior in general, I can say a few words about that.

I would like, first, to make the observation that over the years that I have dealt with source terms, severe accidents, and levels 1 and 2 PRAs, I have come to realize that assessing these important aspects of nuclear safety is largely an exercise in thermal hydraulics, chemistry, and aerosol physics. In the past, this series of conferences has made very substantial contributions to the field of aerosol physics and how to effectively clean aerosols and gases from air spaces and streams.

If you look at todays NRC's research effort on aerosol behavior, it is mostly limited to evaluating a few of the source magnitudes. NRC has proclaimed that they no longer need do research on the subsequent transport behavior of aerosols. Why have they reached this conclusion? They say because, in the overall assessment of risk of nuclear power plants, the uncertainties are very large and thecontribution that is due to uncertainties in the aerosol transport behavior is very small compared to the other sources of uncertainty. If this is indeed true, then I take it as a tribute to the fine work that has been done in this area by you and others. But, will this remain the situation for much longer?

One of the very strong trends on the international nuclear scene for "new generation" nuclear power plants is that the containment must be designed to cope with severe accidents - meaning that they will not fail under even the lowest probability severe accident sequences.

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* I am required by the by-laws of ACRS to announce that I do not represent the committee and that the views I express are my own and are not necessarily those of the committee.

Along with this requirement for the containment to maintain its integrity under severe accident conditions, is a requirement that the release from the containment must be kept low enough that there will be no need for an emergency response.

These are, indeed, very stringent requirements. I just returned from a week-long meeting in Vienna for the IAEA in which the subject was....how should the source term be specified for such new generation plant requirements for use in containment and ESF design and for assessing compliance with the possible regulatory requirement of no evacuation.

One question we wrestled with a great deal in Vienna was...just how do you specify a fission-product/aerosol source term for a future plant of unknown design and give freedom (and even incentive) to the designer to choose such design parameters as reactor type, power, power density, fuel and cladding design, burnup, quantity of water available to the reactor cooling circuit, and strategies for coping with ex-vessel phenomena? If you have any thoughts or suggestions on this, I would like to hear about them before the follow-on meeting to be held in November which is supposed to come to grips with this issue.

Let me tell you now though that if these are to be new requirements, then the complete spectrum of aerosol considerations and their uncertainties jumps back to front and center. We may have to reconsider the need for additional research in this area.

Of course, nuclear aerosol research is still needed for decontamination, fuel reprocessing, waste treatment, and waste storage. If, also, it does re-emerge for nuclear reactor safety, then what are some of the areas that may need additional research or sharpening up?

Well - back in 19 ought..?????, when I was actively developing and conducting research programs on nuclear aerosols, times were very good. *How good were they?????* They were so good that my group had more research then they could actually handle. Therefore, I always made it a habit to keep in my left hand desk drawer a list of potential future aerosol research areas to follow-on with when we completed the ones that we were currently working on. In today's times of limited research money, I don't think this would be a successful strategy, but it worked well back then.

So, in preparation for this talk, I went back to my files to see if I could find my old list. Sure enough, it was still there. This is a list, mind you, that I made back in 1986 (before Chernobyl) which was essentially the time I quit being a researcher to become a Department Head -- a fate I would not wish on any of you.

[Slide number 1]

Ten years later, I do not really know the status of these, but I would bet that this would still be a pretty good list to start from. I meant to do as many of these as I could, but I didn't get the chance. That is why I have subtitled this talk "unfinished business." I no longer have a use for this list so you are welcome to it.

Before I leave this list, there is one more research area I nearly forgot. The British think more research is needed on the effects of smoke. They have concluded that smoke is an essential ingredient in making electronic and electrical equipment function properly. They reached this conclusion because of an astute observation that every time a piece of such equipment failed or malfunctioned it was because the internal smoke had escaped - they could see it leaving the piece of equipment. They conclude that better means to keep it from escaping are needed...an imminently reasonable conclusion don't you think.

In parting then, I don't think I could do better than to quote from Mel First:

[Slide number 2]

> "These conferences have been a force for advancement as well as a forum for refinement of current technology."
>
> "The conference will continue to be highly involved in the important task of maintaining and improving engineered safety features for existing power reactors and with meeting the air cleaning and treatment needs of advanced reactors."

I can only add ...keep up the good work and I trust this Conference will be as highly successful as have been past ones.

POTENTIAL NUCLEAR AEROSOL RESEARCH PROJECTS

THE FOLLOWING WERE COPIED FROM A 1986 LIST

1. THEORETICAL VALIDATION OF THE GRAVITATIONAL SETTLING ASSUMPTION/MODEL
2. A BETTER MODEL FOR SHAPE FACTORS AS FUNCTIONS OF AEROSOL SIZE
3. DIRECT EXPERIMENTAL MEASUREMENT OF AND (AS FUNCTIONS OF AEROSOL SIZE AND TYPE)
4. EFFECTS OF HYDROGEN BURNING/DETONATION ON AEROSOL SIZE (DE-AGGLOMERATION AND EVAPORATION OF ABSORBED WATER)
5. CHEMICAL EFFECTS ON AEROSOLS (MOISTURE, H_2 BURNING, ATMOSPHERIC OXYGEN).
6. LIFT-OFF/RESUSPENSION
7. BETTER CODE TREATMENT OF MULTICOMPONENT AEROSOLS.
8. EXPERIMENTAL DETERMINATION OF THE NUCLEATION SIZES OF AEROSOLS . RELATE NUCLEATION SIZE TO MACROSCOPIC PROPERTIES.
9. AEROSOL SOURCES FROM STEAM EXPLOSIONS.
10. EFFECTS OF AEROSOLS ON RECOMBINERS.
11. BETTER IMPACTION DEPOSITION MODELING.
12. EXPERIMENTAL VALIDATION OF DIFFUSIOPHORESIS MODELS IN PRESENCE OF NON-CONDENSABLE.
13. BETTER MODELS FOR AEROSOL TRANSPORT THROUGH CRACKS IN CONCRETE CONTAINMENTS.
14. EFFECTS OF RADIATION-INDUCED CHARGES ON AEROSOL BEHAVIOR IN CONTAINMENTS.
15. EFFECTS OF AEROSOLS ON ELECTRONIC EQUIPMENT.

QUOTES FROM MEL FIRST

"THESE CONFERENCES HAVE BEEN A FORCE FOR ADVANCEMENT AS WELL AS A FORUM FOR REFINEMENT OF CURRENT TECHNOLOGY."

"THE CONFERENCE WILL CONTINUE TO BE HIGHLY INVOLVED IN THE IMPORTANT TASK OF MAINTAINING AND IMPROVING ENGINEERED SAFETY FEATURES FOR EXISTING POWER REACTORS AND WITH MEETING THE AIR CLEANING AND TREATMENT NEEDS OF ADVANCED REACTORS."

DISCUSSION

FIRST: The talk is open for questions and comments. I would like to ask Tom to comment further on the long list of projects you wrote down approximately a decade ago. I gather that they have not yet been accomplished.

KRESS: I meant to do all of them, but I got out of the business about then, and that is the reason I listed them as unfinished business. At least they are unfinished for me.

FIRST: What do you think is the most important area that we should be concentrating on now, assuming that somebody will come up with adequate funds, which I realize is somewhat uncertain these days.

KRESS: That is a tough question, but I will try to give you a quick answer. I think that better, higher capacity HEPA-type filters that do not fail under loads that are relatively large, would go a long way toward solving many problems, I think that would be my choice.

INTRODUCTION

FIRST: As I mentioned earlier, we have three seminal papers that will occupy the rest of the morning, and I do call your attention to these papers because I think they are opening new ground. They are of extreme interest at present and will continue to be into the future. The first of these papers will be presented by Dr. Ronald Bellamy. Many of you know Ron, he's been a constant attender and contributes at these Conferences since he left Ohio State University and joined the Nuclear Regulatory Commission. Because his doctoral thesis work was in activated carbon, he came to AEC headquarters at an opportune time with all the knowledge and assurance of a newly minted Ph.D. A nice thing about Ron is his consistency, he is still very positive and he has maintained his enthusiasm and elan through the years. He is my very valued colleague. He is presently Chief of the Decommissioning and Laboratory Branch in Region One of the Nuclear Regulatory Commission. He is on the ASME and ASTM committees on standards and on the Program Committee for this Conference. He's a visiting lecturer at Harvard University and lectures in the course that I am associated with, the In-place Filter Testing Workshop, as well as Dade Moeller's course on Nuclear Emergency Preparedness issues.