

SESSION 3 DISCUSSION

Co-Chair:
(Bari) As Frank Congel mentioned earlier, the seventh paper in this session will not be given today but later on in this conference. The author has not arrived at the meeting site yet, so stay tuned, it will be presented on a later date. This concludes the formal presentation in this session, and we now turn to that portion of the session in which you, the conference participants, get to query the authors on topics that go beyond the specifics of their papers. The only constraint here is that you stay as close as reasonably achievable to the topic of the session, the intersection of ALARA at Advanced Reactors. I would now like to ask the six authors to join us at the front table and we will open the panel discussion.

Khan: I have a question for Charlie Hinson. You saw that between Sizewell B and Sizewell C there has been potentially a very drastic reduction in estimated plant dose. Now, the advanced reactor designs in the U.S., I understand, are going to be standard designs. If we see any possibilities of reducing doses very drastically by some techniques, how much provision is there to incorporate that into the design after the design has been frozen?

Hinson: As I stated in my paper, one of the objectives of the current review process being used to review the "next-generation" reactor designs (in accordance with the new Standardization Rule) is to end up with a standard nuclear power plant final design which can then be incorporated into individual facility license applications. Once a design for a "next-generation" plant has been approved by the NRC (through the issuance of a Final Design Approval (FDA)), it may be several years before a utility decides to purchase one of these plants and incorporate the design into their license application. In the interim period between the issuance of the FDA and the initiation of actual plant construction, technology may have improved so much that some of the plant components may be outdated or obsolete. The FDA allows for such changes to be made to the plant design based on improvements in technology. For example, the "next-generation" reactor designs state that the cobalt content of piping and other components in direct contact with the reactor coolant be restricted to 0.05 weight percent. Several years from now, it may be cost effective for utilities to manufacture reactor coolant piping which limits cobalt content to 0.02 weight percent or less. If this is the case, then the NRC will encourage the use of the lower cobalt material. For other areas, such as plant shielding, the specifications (materials, dimensions) for components used to store and process radioactive wastes are not currently provided in the plant design. These specifications will be determined at a later time by a licensee wishing to build one of these "next-generation" design plants. Once these specifications are made, then the shielding design can be finalized. To summarize, there is sufficient flexibility in the final plant designs approved by the NRC to allow for design modifications to reflect improvements in technology. Some of these modifications could result in lower plant doses.

Co-Chair:
(Congel) Let me add a little bit to what Charlie had to say. First of all, there is the hearing that has to be held before the final design approval is specified with all of the requirements of the form of the ITAC, the inspection test acceptance analysis criteria. So there's still a couple of years during the hearing process. Secondly, with maybe just a few exceptions, final materials are not stated composition wise. What is really stated are requirements for specifications to be met in terms of strength, size, capacity, seismic resistance, things of that sort. So when it comes to actual materials specificity, there could be a continual learning curve and until a plant is actually ordered and there is all the steam supply

system matched to the reactor design, only then are things truly finalized. So there is quite a bit of time left, and I have to emphasize that design approval does not go down to the depth of detail that specifies "this is the composition you have to have in material." That's not the case. Just the requirements it has to meet in terms of what I just said is what is truly specified.

Robinson: All the ALARA that we have been hearing about today has all been concentrated on occupational exposures during normal operations. I was just wondering if any of the people talking about the designs have thought about one of the Achilles's heels of the nuclear industry and that is on the decommissioning side. How have they thought about minimizing doses during that phase of work.

Hinson: The design of the "next-generation" reactors does incorporate features to facilitate decommissioning. Several of the design features that are incorporated into the plant design to minimize doses during operations, such as using modular components and shielding, etc., are the same features that would be used when decommissioning a plant to lower personnel doses. The use of modular components, simplification of design, plant shielding, improved plant accessibility, and the way the plant is designed so that a majority of the components can be removed from the plant without cutting the components into sections are some of the same features that would facilitate decommissioning of the facility.

Zodiatas: I would like to add something else. The dose during the decommissioning comes from basically two sources. First is activation of components of the primary circuits in particular and the concrete around the primary vessel, and second, from contamination of the structures which need to be decommissioned. In terms of activation, this can be reduced by reducing certain impurities in the reactor pressure vessel (RPV) and primary circuit materials but there are limits how far that can go because the RPV is made of stainless steel. In terms of contamination, by reducing radiation sources which help operator doses, by reducing the spread of contamination, which again reduces operator doses, you achieve a reduction in decommissioning exposure. In addition, the provision of decontaminable surface finishes in many areas, which again will include operator doses during operation easily enable decontamination of the surface for final decommissioning. So, the operator dose during operation and the dose during decommissioning go very much hand in hand. By reducing one, you achieve reduction in the other.

Meinhold: I was just intrigued by the suggestion that we could improve things by people going to work. Turning that around, I just wondered if you thought about the latest ICRP recommendations which say that we should include all the radiations received while at work, meaning that the radon and the external radiation from the concrete that you brought in there to give all this protection is going to actually irradiate them even greater with the natural background. I just wondered if you thought about that in some of your advanced designs.

Zodiatas: My comment was made with tongue in cheek, but there is a bit of truth in it. In terms of external radiation, we do account for it because our film badges do respond to all radiations in the environment. In terms of radon exposure, we are probably much safer in our stations because of all the heating, ventilation, and air conditioning (HVAC) we provide to keep airborne contamination low. I don't have numbers in terms of radon exposure, but I do know we have a lot of ventilation in our stations which would minimize the exposure to radon.

- Haynes: Maybe I could just comment on that, too. I'm not really answering Charlie Meinhold's question, but certainly in our environment where we put a lot of emphasis on self-protection and a lot of emphasis on training, we go to fairly extreme lengths to at least put natural background radiation doses into perspective with occupational exposures, and there's no question in the newer plants we're getting to the point where the two are very comparable in any given year. It's important that people understand that so that we don't bend the ALARA equation too far in the wrong way.
- Lee: I'm from the Korea Institute of Nuclear Safety. I have a question for Mr. Crom for System 80+. Do you have any definite figures or estimation for interlock system when you have the in-core monitoring was pulled was pulled out from Duke Power Engineering experience?
- Crom: No, but the Duke Power experience is based on a different type of configuration than the Combustion Engineering (CE) design. What you are asking is what the actual dose in that particular in-core is? We have not gone through a detailed calculation of what it is for the System 80+ design to date. This will be done during the very detailed design through the design acceptance criteria.
- Lee: I don't know whether I can give you this in figures, but you have technically no open items, but I know that you have nine confirmatory items. Does that include the in-core monitoring system or not?
- Crom: No. The confirmatory items are mostly procedural in nature. It is basically incorporating agreed-upon commitments with NRC into the final SAR to insure that all the commitments are included. Resolving confirmatory items is basically just an editorial exercise of the final SAR plus an integratived review by the NRC of the SAR and ITAAC tier-one document. The NRC did a separate review between the tier-one and the SAR material to make sure that they matched up.
- Westbrook: At Oak Ridge National Laboratory we are working on the advanced neutron source reactor design, which is kind of a new reactor to end all new reactors. Being a research reactor it doesn't necessarily have all the basis of experience that the nuclear power plants have. However, as a radiological person who is consulting to the design team, I have some problems with them based on how to come up with the dose estimates. They will ask me, "what is an acceptable dose rate for this area," and I will say, "you tell me what work is going to be done there, you tell me how many hours a year occupancy, and so on, and we will figure how much shielding we need to correspond with some reasonable dose rate." And they say "well we will have to figure out how many man-rem are going to go to maintenance of this, maintenance of that, normal operations, inspections, and so on, and they are trying to figure this out. But they keep coming back to "we can't figure out the dose until we know the dose rate." The shielders say, "I can't tell you how much shielding until you tell me how much dose rate you want on the other side." Then they also go back, "Well, what are the source terms?" See, we go around and around with this. The nearest equivalent reactor is the Institute Laue-Longevin in Grenoble, France, but that, if memory serves, is something like 20 years old. So it has not had all these improvements that you are speaking of. When you guys are doing all these estimates and dose estimates, how do you handle this "dosi-do" problem of "you tell me first, then I will tell you." Do you always start out with some set amount of source terms? You can do that with the core, but then you have to process it in some way and say "we expect so much in the steam generator, we expect so much at our hot spots, we expect so much in the

condenser..." How do you handle this problem of trying to get someone to make the first estimate and then somebody else refines it? How do you handle this?

- Crom: First of all, as far as source term, that's pretty straight forward for current generation plants. We determine what the source is based on one-quarter percent failed fuel and then go through the various processing through filters and demins of the CVCS system and know basically what that dose of all the components is going to be. From the standpoint of shielding, we then had our people who have done dose analysis over and over again for current plants judge what they think the dose should be in the adjacent areas. We know what it will be in the cubicle from the equipment based on that source term analysis, now what do we want it to be in the adjacent area. What we have put into the SARs are radiation zone drawings of what we want the dose to be. We then developed design acceptance criteria to do the detailed shielding once piping is routed such that we then can do the shielding calculations. Then we have to maintain those within the limits we show in the radiation zone drawings in the SAR.
- Lau: I'll speak to that briefly. My experience has been that we can establish desired access times and then it becomes somewhat of an iterative process to determine whether or not it is practical to meet those or whether or not you need to reallocate the space or redesign the equipment locations so that you can actually meet the shielding requirements without eating up all the space available for the shield. So it is somewhat iterative, but you should be able to establish at least a desired access time based on known maintenance, and in your case perhaps experiment loadings and things of that sort that have to take place in the reactor area.
- Co-Chair:
(Bari) Would anyone else like to comment on that? I have a question. A few of the authors compared their results with the EPRI limit. Can you tell me what the uncertainty is in your calculated estimate?
- Crom: Maybe I'll take first crack at that because I asked Charlie why I didn't get credit for 30-40 man-rem because we thought we had the same improvements. We think we were conservative in our particular estimate. We think that if we do a detailed time and motion study with source terms per some of the NUREGs in the detailed design, we will have lower estimates.
- Zodiates: In Sizewell-C, we carried out two dose assessments. One assessment was based on dose rate measurements from equivalent plants, and then we calculated the dose by defining what work needs to be done, how long it takes to do the job, how many people, etc. Starting from the dose rate measurements you have at least a 10% uncertainty in defining and measuring a dose rate. So my judgement is that our dose estimates are of that same order of uncertainty.
- Hinson: For the most part, the dose assessments contained in the applications for the "next-generation" reactor designs do not contain the level of detail specified for a dose assessment in Regulatory Guide 8.19. This is because, at this stage of the plant design, the exact piping layout and the specifications (such as component size, shape, placement, and material composition) for the components containing the radioactive source terms are not known. Without this information, the exact amount of shielding used cannot be determined. In addition, the determination of the number of personnel working at the plant is the responsibility of the license applicant. Without accurate knowledge of plant shielding or the number of plant personnel, the plant designer cannot perform an adequate dose assessment using time/motion studies (as is recommended in Regulatory

Guide 8.19). Therefore, there is a possibility that once this missing information is known, the plant collective dose estimates calculated by the individual plant licensee may be lower than the currently provided dose estimates.

- Lau: I started to say that most of us are reluctant to hang a number on the degree of conservatism, or whatever you want to call it, that might be in those estimates, but at the same time it is going to vary based on our experience level. If it is a job that you have a lot of experience doing and you know exactly how things are going to be in regard to the dose rates and also in regard to personnel and their time to do the job, that particular estimate may be quite accurate. Again, I don't know if I want to put a number on that, but on the other hand, newer jobs that you do not have experience with are going to have less accurate estimates. When you add them all up you have a cumulative mixture of accuracy. We could all make a guess, and that's about as much as you can do at the moment.
- Baum: I recall that during the design of the Sizewell B facility there were many cost-benefit analyses done on some of the major engineering modifications that were being considered, and I wonder if similar studies are being done on the other plants, and if so, what are the criteria being used to judge the cost-effectiveness and where you should draw the line. Maybe you can call \$/Sv values, or how is this being decided, how low one should drive the dose number.
- Haynes: I'll just comment on that in a very general way. It's a tough question to answer and certainly one that we struggled with. At the Darlington plant, for example, we've come under some criticism, I would say, in terms of reducing dose rates too far. We've spent too much money. The nearest plant to it in terms of design is Bruce B, which started up in the mid-80s is a four-unit plant, currently operates four units typically for about 150 man-rem/yr. Application of the dose-reduction measures that we used on Darlington throughout the 1980s and using the process I described resulted in the initial dose estimates coming down by roughly a factor of three after the iterative process of applying various dose-reduction measures. And you really question whether that is good value for money in the end, given the other problems that we have to deal with, not only on the nuclear side, but on the other side, of our company's business. I don't know precisely the answer to your question, but it certainly is worth asking and raises the whole question of cost-effectiveness of dose reduction.
- Lau: I might add to that for the AP600. We have performed some cost-benefit analyses basically by using the industry-accepted cost per man-rem that is in existence today, of around \$10,000-\$12,000 per man-rem. Using those numbers, we have generally been able to show whether a particular design or requirement such as the amount of cobalt impurity, or whatever it might be, has a practical limit. This methodology can be applied to more situations than we have evaluated so far, and I think it will be as we go through our final ORE estimates.
- Co-Chair:
(Bari) Would any other panelist like to tackle that?
- Crom: I am pretty much in agreement. We have done some cost-benefit with similar type analysis, but again, when you start getting down in less than 100 man-rem, you start questioning your cost-benefit analysis. Most of the analysis we have done is for off-site, where severe accident doses is the concern. Major design features for severe accident analysis were evaluated on a cost-benefit basis.

- Co-Chair:
(Bari) Are there any other questions from the audience?
- Ferguson: This is a question not only to the panel but to anyone in the audience who would like to answer. Listening to Mr. Tom Crom in his discussion on System 80+, and Mr. Fred Lau in his discussion on the AP600, it appears that their advanced light-water reactors for U.S. plants are addressing new source terms in terms of post-accident access requirements. Is the nuclear industry in Europe shifting toward a similar type of new source term approach, or what is the status over there for their advanced light-water reactors?
- Lau: I will start off with what I can recall on that subject. With regard to using the new source term definitions in the NUREG, the existing plants have not started to use it, or at least are not headed in that direction at a rapid rate, partly because if you are going to change, you have to change, as I understand it, all of the accident source terms in the NUREG, not just one item. It would be nice to cafeteria shop through the list of things that might help your plant if you go to the new NUREG, but if you really are going to use all of the requirements that are there, it becomes a pretty extensive proposition and probably more than a lot of utilities at this time would want to get into without at least having some idea of what that is going to cost them.
- Crom: I think the System 80+ experience is a little bit different because the new source term we are using does not use any new removal mechanisms. I believe the AP600 is using different removal mechanisms for the passive plants. Current plants would most likely see an improvement, if they utilize new source terms, in elimination of technical specification LCOs on the carbon filters. That was the greatest benefit as far as System 80+. Sreela is more familiar on this than I am. Eliminating technical specification limits on the Reg. Guide 1.52 test eliminates limiting conditions for operation should the test fail. This would be the biggest benefit that current plants could see, and they could probably eliminate the carbon filters all together. In System 80+ we still have the carbon filters because we have a stringent atmospheric dispersion factor in determining normal 10 CFR 20 and Appendix I limits. For this reason, we are still required to have non-safety carbon filters in the ventilation systems. But we were able to eliminate all the technical specification limits on all carbon filters except for the control room ventilation filters.
- Ferguson: I think that I may not have expressed myself properly. The question I had was not the advantages the current nuclear plants would have if they switched to the new source term. There are many advantages. What I was really trying to find out is what the European nuclear industry, in the advanced light-water reactors, whether they are going to switch to the new source terms or something similar to that or whether they would stay with what their current regulatory requirements are based on. It was more of a questions on the European nuclear industry.
- Zodiates: I think that is more of a question, not to the utilities, but to the regulatory board, because they define the rules of the game and the utilities operate by the rules.
- Ferguson: And there is currently no such focus in the European Regulatory Boards.
- Zodiates: Well, we have a few presenters here. Maybe they should give us their view.
- Chair: Would anybody out here like to handle that?

- Crom: Let me take a little stab at that because I was involved in a study for British Nuclear Fuels and I believe that the old TID source term was a lot more conservative than what is currently used in the U.K. In fact, I think the UK currently uses source terms closer to our NUREGs. More realistic severe accident source terms compared to what the U.S. has; at least that's what my experience was in dealing with British Nuclear Fuels.
- Mirda: I'm from the Industrial Hygiene section of Consolidated Edison. My question is geared toward ergonomics. In the design of these new generation power stations, is ergonomics being incorporated into the new designs, and is the maintenance in a lot of these systems being looked at with maybe auxiliary type systems and equipment to expedite work on some of these systems. In our stations we see a major portion of doing some of this maintenance work involves just getting to a valve or setting up an area.
- Crom: Let me take the first shot at that, and the answer is yes. We have spent a significant amount of time looking at the maintenance and the access. One of the things that we have recently done is to look at the staffing level. For the nuclear industry to continue, we are going to have to reduce the operation and maintenance costs from where they are in current plants. One of the main things that the industry is trying to do is to reduce the staff. The current 1300 or 1100 MW may have staffs of 1,100 people per unit. The estimate that we have done for System 80+ is somewhere around 750. A lot of the reduction is in maintenance personnel. Improved access and design of systems will require less maintenance and less maintenance staff.
- Lau: As far as the AP600 goes, I know that we have looked at what is required for such operations as removing a reactor coolant pump. As I indicated, we have a cart for pump transfer, many different ways in which you can perform a job with less people, robotics -- all of these things go in line with your question. As far as the number of people for plant operation, the AP600 sort of starts as a base by looking at the Point Beach Plant, and here you are talking, I believe, 250 people as an operating staff and probably AP600 should be able to function with that number or less, although I've not followed the progress in that particular area recently.
- Haynes: Let me comment on that briefly. Certainly, in the design of our Darlington plant, I would say one of the best things that we did was to allow more space for maintenance in areas where that is required. It is particularly important in most of our work areas because of the requirement for tritium protection, and therefore, you are wearing supplied plastic suits and we also always have to allow for air supplies. There is no question that we did that. We we did not do it very well at all in the design of our tritium-removal plant, and we got stuck with a fixed design and we are paying for it now in terms of ease of maintenance.
- Khan: My question is to Rolf Riess. I wonder if in the newer Convoy designs, where you have these very low doses, were there any other measures taken, things like compartmentalization of components, bigger laydown areas, all kinds of other measures that the other people have talked about, or are those designs essentially identical with the older designs except for the removal of cobalt from the internals?
- Riess: I would like to answer this question by simply showing a slide. This slide shows the exposure as a function of the calendar years, again, the three groups that I discussed during my presentation. If you consider the changes that were made from the first to the second group, there is no difference in the materials concept. That means, regarding the design of the unit, access to the unit, the options for maintenance, all these aspects have

been introduced into the second generation and, of course, into the following generation of plants. There is a similar scale jump from this so-called first generation of plants to the second one in both design and shielding. And the final step is then to implement or to reduce the sources of cobalt-60 and cobalt-58.

Na: This question is addressed to Mr. Hinson, NRC. I would like to know the NRC's position for whether it is an evolutionary or passive-type reactor, will you try to implement what we call the TEDE, the total effective dose equivalent concept or not?

Hinson: Yes, the staff will definitely implement the TEDE concept described in the new part 20 in all future passive and advanced reactor designs.

Na: My next question is to the two vendors of the AP600 and System 80+. Do you have any definite schedule to meet those NRC requirements?

Crom: As far as the System 80+ is concerned, we did change from the old 10 CFR 20 to the new 10 CFR 20, not only for shielding and airborne concentrations inside the plant, but also for a fluid analysis that we did for liquid and gas releases. The new 10 CFR 20 requirements are also in our radiation protection design acceptance criteria (DAC). We have to meet those particular limits in the new 10 CFR 20 in the detailed design.

Lau: I believe the same answer would essentially apply to the AP600. All of the access criteria for the various locations throughout the plant where you would do maintenance and other operations have access times and commensurate compatible dose rate requirements that meet the new 10CFR20.

Egner: Rolf Riess, you have been extremely successful with your Convoy plants. You could show figures down to, say, 20 man-rem per year, and you still have plans for future improvements. Could you really motivate further work from cost-benefit point of view, and why do we stop? Soon we are talking about a fraction of a man-rem per year for 1000 megawatt reactor.

Riess: The question was already raised during the presentation, what further improvements do you have in mind. Of course, you are right. If you start discussions with utilities what is the value of reducing, let's say, 20 man-rem per year to 19 man-rem per year in plant, so you will never end up with a cost-benefit or a benefit on your side as a utility. But the philosophy in German is that if you can introduce new technology which helps you to keep radiation fields down, it should be introduced. I mentioned a few things like reducing the Inconel surface in the system, consideration of implementing trace element injection into the primary system. This comes specifically from the older plants. Again, if you recall the slide that was just shown, we have these old plants which have high radiation fields and one of the simple considerations is just backfit the old plants with the features of the new plants and you should come down. But it is not so simple. It would take another presentation to explain why we couldn't or can't make these changes in these operating plants. Numerous political aspects are playing a major role in this regard. So we are looking for new solutions and they will be implemented. I wasn't involved in answering all the questions when reg guides came up saying you have to fulfill this. This is due to the fact that we have in Germany a different kind of philosophy. In the past, I can't tell you about the future, but in the past, if there was a technical problem, the German philosophy was to find the best technical solution and implement it and there were no major cost-benefit studies made on these issues. The best technical solution was implemented. And it was not ALARA principle, it was a principle which we called As Low As Possible,

ALAP. The best solution to reduce radiation fields was implemented. So coming back to your basic question, do you see any chances for improvement. Yes, I see. But if a cost-benefit analysis is required, then you can state it would be extremely expensive, at least for the recent plants, to implement these features.

Chair: Are there any other questions, statements, by the workshop participants at this point?

Hinson: I would like to expand on an answer to a question that I was asked earlier concerning whether the "next-generation" designs addressed the issue of temporary shielding use. The level of detail in the "next-generation" reactor designs which are approved by the NRC (through the issuance of FDAs) are lacking in several areas. It is the responsibility of the individual licensee wishing to incorporate one of these "next-generation" designs into its license application to provide certain details such as operating procedures, organizational structure, site-specific details, etc. Although the "next-generation" plant designs all state that temporary shielding will be used when needed, it is up to the individual licensee to specify how much temporary shielding will be available, what types of temporary shielding will be used, and the procedures and criteria for when and where this temporary shielding will be used.

Rescek: I asked a question during your presentation on the temporary lead shielding. I guess the question I am really looking at applies to the regulatory process. I understand that there are concerns over hanging lead on safety-related systems, and as a part of the process of looking at these new designs are the regulators going to be looking at how much lead and to what extent lead may be considered in the future when these plants are built that might be hung on these safety systems so that we don't get into the issue now of dealing with the regulators at our regions about "can you hang lead on this system or not, and where is your justification." I'm looking for a little bit of more proactive relationship between the designers and the NRC on addressing this issue.

Crom: Let me address that a little bit. As Charlie said, a lot of the piping analysis is not complete as far as design certification. The issue you discussed is whether it is considered as a piping loads and the pipe stress analysis. The answer is yes, it will be in the detailed design. That is one of the loading requirements in our piping analysis criteria contained in the SAR. I believe it's also an EPRI URD requirement that you consider the loading of lead shielding. We plan not to use a lot of lead shielding; however, in situations where you may be doing a unique maintenance situation, it may not have been considered.

Rescek: Yes, in fact, there is a paper Wednesday morning with Sargent & Lundy and Commonwealth Edison co-authored about PC-based programs to calculate the loading that you can put on some of these lines from a seismic standpoint. But we spend lots of money every year doing these types of analysis, and, in fact, the industry as a whole probably spends millions of dollars a year on these analyses to hang lead. If there is something that can be done on the front end, either put permanent shielding in these locations to minimize the use of temporary lead shielding, or to make it easier to pre-approve some of the areas where you think you are most likely to have the need for temporary shielding, that being done up front could save the industry lots of dollars down the road that we are spending today hanging lead on the existing plants.

Crom: I definitely agree from Duke Power's experience.

Riess: I would like to make a comment again on the previous question directed to me, namely, why do I look into further improvements to keep down radiation levels. Again, we take

the position and the philosophy that you have to prepare for the future, and there are a few clouds on the horizon as we see it. I will give you an example. The economics in our country and I think worldwide for the nuclear stations is driving the operators to go to longer cycles, to have higher thermal efficiency. Immediately one starts to consider higher void fractions in the core, start boiling. This is a serious consideration. If that is done all of a sudden plant chemistry will be taken to the limits because you will concentrate lithium, thereby increasing fuel corrosion. This, in turn, requires reduction of lithium again, and that increases radiation fields, bringing us back to the old cycle. So you have to be prepared, and you have to have new answers for the questions showing on the horizon.

Co-Chair:
(Bari) Would the panelists like to query each other? I know you've had a long, exciting first day of the workshop. I congratulate you on your stamina and attentiveness during this long day. I would like to thank my co-chair, Frank Congel, for participating. Finally, I would like to congratulate and thank all the panelists/authors for participating through this session. This session is closed and have a great evening.

Baum: Before you leave, I would like to close the technical meeting for today by saying that I am really impressed with the things that we have learned today, with the progress that has been made in the past five years since our last workshop, and I'd like to thank all the speakers for their very excellent and informative presentations.