

Transcript of Interview with Current and Former SAGSI<sup>1</sup> Members:  
Jim Casterton, Dieter Tillwick, Roger Howsley, Kaoru Naito and Jim Tape

Interviewed in Tucson, AZ by Tom Shea and Rich Hooper

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Shea: Hello, I'm Tom Shea of Pacific Northwest National Laboratory. We're in Tucson, Arizona today at the JW Marriott Starr Pass Resort taping a session that is part of the Foundations of International Safeguards series, sponsored by the National Nuclear Security Administration.

My experience was to spend 24 years working at the International Atomic Energy Agency in the Safeguards Department with a variety of responsibilities. Then I've been at Pacific Northwest National Laboratory. On my right is my co-moderator, Rich Hooper.

Hooper: Thanks, Tom. I've been at this business in one form or another for nearly 40 years. That included extensive experience at the Agency, and with the whole exercise of strengthening safeguards. I left the Agency in 1998 and have continued to work as a consultant, working in Japan, and also continuing to work for the Agency. With that I would invite our SAGSI guests to introduce themselves, beginning with Jim Casterton, who is the current Chair of SAGSI.

Casterton: Thank you, Rich. Yes, my name's Jim Casterton. I've been the Chair of SAGSI now since the first of January 2007 so it's not a wealth of experience there. I've been on SAGSI since 2001 and have enjoyed my experience tremendously. I also have been in the nonproliferation business since 1982, when I joined the Atomic Energy Control Board as a nuclear nonproliferation officer. In that capacity most of my experience was related to bilateral nuclear cooperation agreements, export-import control mechanisms, and for the next 10-15 years I was able to assume increasing roles and responsibilities in that area. I came at safeguards at the time primarily through other mechanisms – such as the NPT Review Conference process, where I was quite involved in Committee II, which focused on Article 3 issues related to the NPT. And so in that context, having attended the NPT Conferences since 1985, I was dealing with safeguards and export controls mainly in multilateral dimensions of safeguards and nuclear nonproliferation. I also had the opportunity in 1996, when I became more intimately involved in the safeguards area on a day-to-day basis, because I transferred to the Canadian Mission in Vienna. And I assumed responsibility as the Nuclear Affairs Counsellor from 1996 to 2000. It was as you know a very dynamic time in the safeguards area. When I first went to Vienna we were deep in the process of Committee 24 and that's where I met Rich and worked with him extensively during that time of Committee 24 and then afterwards dealing with safeguards issues, primarily from an Agency perspective, in an interaction with the Canadian government.

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<sup>1</sup> IAEA Standing Advisory Group on Safeguards Implementation (SAGSI).

When I returned back to Canada, in late 2000, from then on I assumed a more leadership role in safeguards - I became the Director of the International Safeguards Division. The area that I work in is actually Canada's SSAC. We are charged with implementing the Canada-IAEA safeguards agreements, and in that I mean our 153 bilateral agreement and the Additional Protocol that we have also signed. We work very extensively facilitating the Agency's inspection activities in Canada. Together with our sister division within the Directorate of Security and Safeguards, we facilitate Agency inspections in Canada and we ensure that all of our reporting requirements are met so that the Agency is in a position to draw its conclusion for Canada annually.

During that time - 2001 as I mentioned - I had the opportunity, I was invited by the Director General to be a member of the SAGSI team and since that time I have worked in that capacity. I have met many very professional, well-qualified and interesting individuals. In that regards I'll turn to Dieter, who is a member of SAGSI and who I would consider a good colleague as well.

Tillwick: Thank you very much. I'd like to go back why did I join safeguards right from the beginning, I've been at NECSA, that's the Nuclear Energy Corporation of South Africa, for 30-31 years. I started off as a nuclear scientist and went into the PWR fuel manufacturing plant, and did mainly all of the verification activities. We were busy with a nuclear weapons program and towards the end of that in the 1980s, late 80s, we got an instruction that we had to put in a nuclear material accountancy system and basically also report on all the nuclear material and activities. That's when my career in safeguards started.

We put that in and when we actually signed the NPT in 1991, we had our first involvement directly with the Agency I still remember that we had the first visits to South Africa and one of the members, ex-members of SAGSI, Kaoru Naito, who is sitting to my left, was part of that visit. And that's where intensive training started. We did implement nuclear material accountancy for about 5 years. I basically, a few years later, took the responsibility to look after the South African SSAC. When we started with that South Africa had been going through a very intensive verification exercise, it was intensive verification activities after the nuclear weapons program, and we were successful in terms of the Board of Governors accepting the verification in 1993. But there were certain outstanding issues. In particular from the NPT, that you do not go back historically in terms of your historical activities. But we did have in South Africa a number of issues, historical, such as waste - HEU waste, etc. And my predecessor at the SSAC had decided at that stage to try and get an exemption from that. Unfortunately this exemption didn't go along with the Agency and when I took over it had already progressed to problem number 1 in the SIR, and this problem number 1 had to be resolved and I started to ask straight away for the Agency assistance, where together with the DOE from the United States, who provided us with the drum scanner, and we started to quantify the HEU in waste, as well as the LEU. That program has now been running for about all of the last 5-6 years and we've almost done about a the third of the drums, which should have been scanned. But in my period with the SSAC we did move to sign the Additional Protocol, submitted an expanded declaration, and in terms of expanded

declaration I can mention that we did manage to get it in time, 80 days after the signing and entry into force of the Additional Protocol, but there were various other issues that we had to address. For example the Member State Support Program we joined in during that stage. And in 2002 together with Jim Casterton on my right, I did join SAGSI and it's been a wonderful experience to look at all the verification activities.

Now since I've got a strong background in management, and quality management, and governance issues, having served on various international committees, on ISO Standards, I more or less looked at verification which should be a rigorous type of activity, and the Agency in its own verification exercises, should look at quality management as well, which it has done, and which is progressing very well. From my experience as well, seeing a number of the verification activities that are in good shape, they are processes that are well controlled, but there's always room for improvement. That is how I got involved with safeguards and still am involved and will be involved at the end of this month.

We have uncovered a clandestine network in South Africa, in terms of the procurement network. An agent has manufactured cascade heads for an enrichment plant. And this will come to court, 31<sup>st</sup> of July. We've asked this court to go into camera. Unfortunately the judge has decided that some of it will go into open court and some will go into camera. And on the 31<sup>st</sup> of July we will start and I will be the first witness to go in open court. Now at this time I'd like to turn to my colleague on my left, Roger Howsley, who's also a SAGSI member –

Howsley: Okay, thanks. My name is Roger Howsley. I'm currently the Director for Security, Safeguards & International Affairs for BNFL, which is based in the UK. And I think probably quite differently from my colleagues, I started out life as a biologist. And I read Life Sciences at university. I can hear all the comments about nuclear plants but I expected when I finished my PhD to go to work on the Viking program, probably at MIT, looking to see whether we could introduce terrestrial life forms into a Martian environment – that's what I thought I was going to do. But I joined the nuclear industry instead. So, I began my career as a health physicist and I applied for a job in 1982 at the company's headquarters when a vacancy arose in the then international safeguards department. And I asked the HR department what it was and they said they didn't know. And they came back and they said it's the closest thing we have to a Foreign Office, they're never there, they're always abroad, so that was always a good indicator. So having joined this I worked with the senior management of that department until I was fortunate enough to be made Director and head of the unit about 10 years after I joined.

Safeguards for me was once described as being too technical for politicians and too political for technicians. And I think that's the appeal of safeguards because it spans that enormous range between things which are terribly technical and things which are politically very important. And I think the other reason why people should think about getting involved with safeguards and nonproliferation and security is to do what I call the airline test. You're sitting in your seat on the aircraft, and somebody comes and sits next to you, you introduce one another, and they ask you what you do. And every time I've

explained to anybody what I do they always say well that sounds a fantastic job, that sounds a really interesting thing to do. I've never regretted a day of my career a day over 20-odd, 27 years, working in safeguards.

Like Dieter and Jim, we've seen a lot of changes over the years. People think of the nuclear program now in Europe as being fairly stagnant. But certainly between the 80s and 90s BNFL was investing about a million pounds a day on new plants. We spent about 5-6 billion pounds over 15 years and all of those plants had to be safeguarded to some degree or other. So it was a very active period for us. And I was very pleased to join SAGSI about the same time [as Jim Casterton] in 2001. And I think that SAGSI has a lot to offer. I think the Agency is a great place. I think the staff are very, very experienced. They do a very, very tough job and it's a real pleasure to try and help them improve what they do. That's by way of my introduction.

Naito: Thank you, Roger. My name is Naito. First name Kaoru. I have a nuclear engineering background. I joined the Japanese government as a public servant and I spent nearly 30 years in nuclear regulation, including safety and safeguards. My first encounter in safeguards is 1977, when we were implementing NPT safeguards agreement in Japan. After ratifying NPT in 1976. I was appointed as the Deputy Director of the Division of Safeguards in Science and Technology Agency, which was responsible for safeguards in Japan. And I was directly involved in revising the domestic law and related regulations to implement safeguards agreement provisions and also setting up Japanese SSAC.

Safeguards has some magic power. Someone said, once you put your one leg into safeguards, then you cannot pull it out, but there will be two of yours later. So once I have this experience then sometime later I have to have these safeguards activities again and again. Three years later I joined IAEA, in 1980 in the System Studies section Division of Technical Development and Support. And this is where I met Tom, the first time, and ever since we enjoyed a nice friendship. I was in charge of Hexapartite Safeguards Project. This is the project by 6 parties to devise an efficient and effective safeguards approach for centrifuge type enrichment plants, because of the sensitivity involved in the technology, technology holders didn't want Agency access to the cascade hall, while the Agency and Euratom wanted to have the inspectors access into cascade hall, so that they are not misused. And so they formed the so-called Hexapartite Safeguards Project, HSP, consisting of 4 technology holders and 2 Inspectorates. Then I drew up a final draft of the final report of the HSP in 1983, when I left the Agency and went back to Japanese government and did several things.

And then I came back to the Agency again in 1988, I was Director of SGDE. In that time one of the big topics was how to safeguard industrial-sized reprocessing plants. And I was involved in so-called LASCAR, again this is a multilateral project to devise an effective and efficient safeguards approach for these facilities. They came up with a final report and they said that with the existing technology, and with advanced safeguards equipment and methods, these facilities can be safeguarded effectively and efficiently. And based on that now we have in Japan Rokkasho Reprocessing Plant and we do

implement the outcome of this report and findings. We have good cooperation with the IAEA so this is what I did during my career with the Agency.

Later I was asked to become a member of SAGSI in 1996 and I'm the only person in the whole history of SAGSI who served two different terms as a SAGSI member. First time was 1996 through 1999, and the second time 2001 through 2006, last December. And I enjoyed my service at SAGSI and during my term it was very dynamic change, shift from the traditional safeguards to so-called Additional Protocol, integrated safeguards. So I was very much lucky that I could be involved in the early development stage of integrated safeguards and how it is implemented and also devising the so-called State Level Approach. And also the review of safeguards criteria. And I'm very much thankful that I could be directly involved in these activities. Now I'm President of Nuclear Material Control Center which is the pivot organization in Japan's SSAC and also in charge of physical protection and safeguards. This is my background. So now I turn to Jim Tape.

Tape: My name is Jim Tape. I got involved in safeguards in 1975 when I joined what was then called Los Alamos Scientific Laboratory, now known as Los Alamos National Laboratory, to apply experimental nuclear physics measurement techniques to the non-destructive assay of uranium and plutonium. I didn't appreciate it at the time; but it was in a sense a good time and a bad time to get into this business. There had been the terrorist attacks at the Munich Olympics in 1972, which had raised the awareness of people in the nuclear materials processing business that they needed to worry a little bit more about the security of nuclear materials and in 1974 the Indians conducted a test of a nuclear device which greatly raised the awareness – international concerns – about nuclear nonproliferation. These events triggered in the United States additional government funding going into the development of non-destructive assay methods, keeping track of nuclear materials, and so on. So while these were not promising events from a world point of view, they had a very beneficial effect for me. They gave me a job at a time when it was very difficult to find employment for a physicist. One of the first things I was asked to do at Los Alamos was to conduct training activities in non-destructive assay and in the course of conducting those training programs I got to meet some people from the International Atomic Energy Agency. That was my first personal interaction with those folks and I was impressed with the difficulty of the job that they had to do. Very challenging. I have had a good opportunity to watch the evolution of the safeguards system over this more than 32-year period. At Los Alamos in addition to training I was involved in the development of non-destructive assay instrumentation and then I evolved into doing systems analysis, and finally got more broadly involved in nonproliferation and arms control policy analysis as a part of this activity, and I retired from Los Alamos in July of 2005. I continue to work in safeguards as an independent consultant. I joined SAGSI in 2002 and continue to work on SAGSI. I have to say it's been just a marvelous experience. One gets to work with just outstanding people on very interesting and difficult ideas, projects, challenges, and as Roger has already mentioned, I think what has kept me fascinated is the mix of technology and policy. It's very important how those two interplay. I come at it as a scientist looking at the policy but

others have policy background and think about the technology – it has been a very enjoyable experience.

Shea: So, during this period, if we go back into the earlier days then, as Kaoru was talking about Japan acceding the Nonproliferation Treaty - that's about the time that I joined the IAEA. My initial activities involved being named to a committee with a fellow named Dimitri Pericose. A technical review committee, which had to do with negotiating facility attachments and the like. But also having some responsibility for SAGSI at that time and at that point there was still the basic interpretation of what the actual safeguards agreement meant – the famous Paragraph 28 of INFCIRC/153 about the objective of safeguards as regards the timely detection of diversion of significant quantities of nuclear material – what is significant? What does diversion actually mean? Then the deterrence through the risk of early detection – what kind of deterrent function and the like?

The system is also interesting from a standpoint of at that point there was no basic structure to the system, no basic criteria and so SAGSI's involvements at the time were to come up with the foundations of can we quantify a significant quantity – one of my contributions was to introduce the concept of conversion times. A Japanese predecessor of Kaoru was Ambassador Imai (sp) who at the time was very concerned about applying things in too rigid a manner and getting into situation that he felt would be inappropriate, so the idea of conversion times was better than a critical time or allowed progress forward – putting into place a system with protracted diversion and abrupt diversion kind of drivers allowed this framework to go forward, on the facilities that were the most challenging, which seemed to be the Japanese ones at least at that time. This was the era of the industrial facilities – German facilities were also very challenging at that point. So in that sense the first era was largely consensus on what should the parameters for safeguards be, what should the budget be to carry out those, the kinds of activities that were necessary in the facilities. From the standpoint of my own interactions working later with Japan as a Section Head responsible for those facilities, Britain, particularly BNFL was extraordinarily helpful and provided the technical background, so in the experience of the Agency it is a dedicated staff but it also has the benefit of a community that is in favor of having effective safeguards.

So in this period the challenges that were met were ones of the definition of a ramping up of inspection effort, training and qualifying people, of sending people to Los Alamos in particular to master these skills of radiometric assay and the like. So maybe now we could have a run around the table and hear from the standpoint of the initial implementation period in your own countries and your perceptions on how the system was being defined at that point and contributions that you would like to point to in that period.

Casterton: Well, thank you. Yes, I think – obviously the beginnings of the safeguards system, the development of the safeguards system, was a very interesting and intense period. There were two angles I think that I would like to mention. One is that I think the environment in which the safeguards system was working. From 1945 Canada has

always been very, very interested in thwarting the development of nuclear weapons and promoting the use of nuclear power for peaceful purposes and set about with other countries, sort of setting the framework by which you could promote, or at least facilitate, the use of nuclear energy for peaceful purposes. Part of that of course was the creation of the International Atomic Energy Agency and also the safeguards system that the Agency was charged with implementing. So I think there's a very strong policy framework in which the Agency and its safeguards system has to operate. It's based on States making commitments to nonproliferation and, more importantly, abiding by those commitments, and the Agency has a very fundamental role I think in ensuring that States do abide by those commitments and at least being able to conclude on an annual basis that that is the case.

So for Canada, creating this environment to facilitate the peaceful use of nuclear energy was very important and I think Canada was very much involved as a country, as a nation, and as individuals, in working toward the development of what is now called the nuclear nonproliferation regime. It was very active in the NPT environment. It was very active with the Agency and with others around the table in a country capacity in developing the 153 safeguards system. It was also very active in the multilateral environment dealing with the nonproliferation policy and export control. There were some things that happened in the 70s that probably shook the system in terms of the efforts to facilitate the peaceful use of nuclear energy, that caused people to say, wait a minute, maybe we need to do certain things, maybe we need to strengthen certain things, be it export control, be it safeguards, or the safeguards system. Things happened and it's a dynamic that continues today. We're still challenged on a nonproliferation policy perspective in the safeguards area. That's because basically what we're trying to do is put in place a regime that in which States will commit to peaceful use and abide by those commitments and there are many motivations for many States not to do that and so we have a suitable amount of challenge there. Canada, we were instrumental, as I mentioned before, in developing the safeguards system, the 153 safeguards system, and our own agreement has been in place since 1972, so we've been trying to implement that successfully since that time and later on with the AP, when we brought that into force in 2000, it was another testament to ensuring that the mechanisms that have come about and are devised to strengthen the safeguards system can be accepted and implemented by member states to facilitate the peaceful use of nuclear energy. So I think that it's important to have the policy framework and to recognize the policy framework. It's important to recognize that the safeguards system, the IAEA, is a very fundamental element of the nonproliferation regime but that regime is very broad. One of the things I seem to have some difficulty with is lack of recognition that safeguards, as important as it is, is but a cog in a bigger wheel. It can't do everything, in terms of promoting and ensuring peaceful use. Perhaps for those who think it can do everything, it creates false expectations. And sometimes creating false expectations for the safeguards system and for the IAEA makes it difficult for us to appreciate the work that they actually do. We have export controls, we have treaty commitments, we have other international and multinational mechanisms that are all directed at promoting the peaceful use of nuclear energy. The Agency plays a very valuable role there. But I think we have to make sure that not only technically does the system of safeguards function very well, we also have to make sure that the political will

and the policy in which the safeguards system is operating is also up to speed and that we do get the commitment from member states to ensure the safeguards system is functioning as well as it should be functioning.

Shea: Thank you very much for that broad and comprehensive reply. As we move forward in the interviews, as I said we're now in the 70s and the 80s and we'll come up to the current challenges and your perspective on the broad scheme is obviously setting a context in which safeguards rests, which is a valuable point.

Tillwick: We come back to one of the latest and newest members having joined the NPT only 16 years ago. Joining the NPT, it was carefully thought about by the government at the time because we had gone through a very difficult period in terms of political change, and also in terms of external political pressure. There was a decision taken to move away from the weapons program. It was decided to join the NPT back in 87. But the decision was made to dismantle the weapons and put material right back into storage facilities, so that when we joined the NPT we joined with a clean slate. This took place in Sept '91. July '91 was the NPT and the comprehensive safeguards agreement was signed in '91. And at the time there were various questions asked, verification activities had to be performed and South Africa was quite cooperative and transparent and actually invited the Agency out in terms of anytime, anyplace, to do verifications. The South Africa inspectorate was open was cooperative as far as possible and within the short period of two years the full verification of correctness and completeness of nuclear facilities and material could be done, and was actually approved and ratified by the Board of Governors. Now this is a very short period of time and I've spoken to a number of people that have been involved in this process - I think Rich has been involved in that process as well - where people said that in terms of their safeguards career it was one of the highlights of their safeguards career to look at the theoretical aspects of going back into historical records, production records 20 years old, looking at material in metal form, in hold-up, to losses and to basically come up with a complete inventory as it should be from the production records. That was a very challenging period. South Africa prior to acceding to the NPT had just 66-type agreements in place and right through the period of the weapons program, strictly adhered to the 66-type agreement. There was no interference with the facilities, although they were on the same site. There was no interaction, interference across the facilities, and South Africa had its own processes developed for enrichment which obviously didn't tie in with the other technological advances. If we take it from there onwards South Africa proceeded basically on the same lines to be cooperative and has throughout strived to strengthen the safeguards regime, internationally as well. And there were many lessons to be learned from South Africa's experience in leaving the weapons program and coming out of it and going in to the NPT. Some of those lessons have been given through various presentations and meetings at the Agency, and even on the SAGSI forum it has been discussed in the past. It is clear that a country that moves away from a weapons program it will probably hopefully be one of the last, or the last country to do that, (i.e. implying that no country will start a weapons program in future) that one looks back at the history, and looking forward that we should always take cognizance of the fact that what was done in the weapons program didn't much benefit the nuclear industry in the state. We are looking to a renaissance in South

Africa with a lot of new a lot of new nuclear power plants coming up. In terms of these new type of facilities, new type of nuclear build which will be coming along will put additional resource constraints on South African SSAC as well as the Agency SSAC and I can just say as far as SSACs are concerned that a lot of work has been done in South Africa but we have an aging population and we have got a loss of turnover to the Agency as well. Our inspectorate is looking to young people to come in to this business-engineers, scientists, technicians that will come help and shall take us into the safeguards next generation.

Hooper: From the standpoint of the evolution of international safeguards the S. Africa dismantling of its previously existing weapons program and its decision to join the NPT was a real watershed event. There were several reasons for that. For 20 years following Board approval of the Model Safeguards Agreement, the implementation of safeguards proceeded under the tacit assumption that States' initial reports, which came a the beginning of the implementation of safeguards, was complete. And the verification process began with the verification of the correctness of those reports. Again, emphasized with the tacit assumption that those initial reports were complete.

What happened in the case of S. Africa is that at the time of the 1991 General Conference, S. Africa had not yet made public the existence of this nuclear weapons program. There was a group of African states that managed to get a resolution through the GC that year that requested that the BOG instruct the Director General to verify the correctness and completeness of S. Africa's initial report. The Board of Governors actually did that, the meeting following the GC that year, and this exercise that followed that – the so-called completeness inspections in S. Africa – this was the first time in the verification activities of the Agency that they ever undertook the task of verifying the completeness of an initial report but in particular in a country where there is a substantial history of substantial nuclear program that existed over a number of years. To say this was a challenging and interesting exercise is an understatement.

As things went along and SAGSI was asked to make recommendations to the Director General on the strengthening of the effectiveness and efficiency of safeguards, Programme 93+2 responding to those recommendations came into existence, there certainly were a number of experiences that were drawn upon by the Secretariat in evolving these set of measures that eventually got put in place, some under the AP and some under existing authority. But I argued and I would argue to this day that in spite of the Iraqi experience, the experience in DPRK, the important experience in safeguards was the experience in S. Africa. The reason that I would argue that is that that experience demonstrated to us what was possible. The Iraqi experience was more of there's some things you have to worry about that maybe you didn't worry about in the past, but the S. African experience from a conceptual standpoint was the important experience because that really demonstrated to us what was possible, and I would also emphasize a number of things that Dieter said, which was that the level of cooperation, in particular the mention of cooperation where they provided access to people, was absolutely essential. If that hadn't happened that s. African experience would have come to a very different conclusion.

Shea: So we see the evolution of safeguards taking place in the sense of the consolidation of the basic definition of the system and then we have one experience that was amazingly beneficial in retrospect in that a country that had nuclear weapons decided to give them up and moreover decided to cooperate in a very aggressive way, assist in making certain that there was no question about its honesty and its integrity in this process. In the other cases, in Iraq and the other countries where situations of noncompliance came about, that experience I think served to establish a base of confidence and credibility and experience within the Secretariat. Now could we go back to Roger and these early days in particular can lead up to current events.

Howsley: Thinking back to the 1980s and this would be from a facility operators point of view because clearly the government was involved in negotiation of the Voluntary Offer around that time, and in 1973 the UK joined what was then the European Union, or the European Community. And it became subject to Euratom Treaty safeguards, and that predated the NPT by a few years. The very first inspection we ever had was in 1973 towards the end of that year, from Euratom rather than the IAEA.

But coming back to the 1980s I remember the first time I went to Vienna with my Director at the time who was in fact the SAGSI member. And that was the autumn of 1984. And he asked me towards the end of that week what I thought about safeguards. And I remember saying to him I really don't understand why it is limited to the verification of declared material because who would divert declared material? And with a sort of slight air of superiority he sort of tapped me on the head and said "well, eventually you'll get to understand what this is all about." And of course it was some years later when in fact it became quite apparent that people don't tend to divert declared material, but they tend to do it other ways.

But looking back to the 80s, the thing for me that was the most significant memory of that was that UK is/was a nuclear weapon state, we had a number of nuclear facilities that were being used for both civil and defense purposes and from being a company I would say in the 70s whose prime responsibility was to make the materials for the nuclear weapons program, in the 80s we found ourselves subject to international safeguards, and the government decided early on that we would separate out all of the civil and defense operations and all of the materials. And that was a huge undertaking. And I think to this day I've remained really very impressed by the line the British government took because I think it's true to say that they were the first and only nuclear weapon state ever to have done that in such a radical way. I think part of it was for commercial reasons because at the time in the 80s we were building large reprocessing plants in hopes to attract overseas business from non-nuclear weapon states, and quite rightly they wouldn't be sending the material to us for reprocessing unless we could demonstrate completely that none of their materials was used for nuclear weapons systems. So we had to make this division. And from a human point of view, in terms of dealing with all my colleagues in the company, it was a real difficult task because culturally the people weren't used to this idea. They weren't used to the idea that inspectors were going to come round. They weren't used to the idea of having to control and account for material in quite the same way as they had

in the past. And I still think now, 20 years on, that the safeguards community has got to work and stay working hard with the operators to help them understand what this is all about. Because we often see it from the Agency's point of view. And I think operators have a huge array of things to worry about, be it safety or security or bringing plant in on time or whatever it may be – and in the UK the safeguards requirements were sort of bolted on in the early 80s and I think that the government's to be really commended for carrying that through and separating out the processes. So, that for me it was less about the development of the safeguards regime and more about the practical implementation of all that. And as far as the UK was concerned, the government put all of the nuclear facilities on the Facilities List, and invited the Agency to designate whatever it chose to – I think quite rightly the Agency designated the fast reactor at Dounreay, the demonstration fast reactor. They designated the centrifuge enrichment plants at Capenhurst, and they designated plutonium stores and some of the spent fuel that was being received in from Japan and elsewhere. Those were the main activities and I had the pleasure of sitting opposite Mr. Perricos at some of the Facility Attachment negotiations about that.

So it was an exciting time but I think we'll go around again later and get to the 90s but I think things change all the time in this business.

Shea: I remember being involved in some of those negotiations also and I was supposed to be the bad guy and Dimitri was the good guy so it gives you a sense of how the personalities of all through the era. In the case of Japan I was very early involved in the negotiation of the facility attachment for the Tokai reprocessing plant. My initial encounter with strategic points I thought this can't be true. That strategic points would limit access? So my first draft of the facility attachment said strategic points were anywhere there was nuclear material at any time. And of course that didn't make the day and so we had to become increasingly clever and one thing we did was to come up with a new category of strategic points, which wasn't at mentioned in the safeguards agreement. There are strategic points for inventory and for flow and for containment and surveillance but we came up with one which was called "other strategic points" which was to confirm operator declarations and allow for timeliness activities at the intermediate process points. So now we come to the case of Kaoru's recollections of Japan and the early days and this was an enormous challenge. Germany and Japan were the two predominant nuclear industry leaders at that point in a non-nuclear weapon era and Japan of course has remained while Germany has gone to the dark side, shall I say...

Naito: Thank you, Tom. First of all I'd like to mention the fact that Japan is a very unique country – as unique as S. Africa – we are the only country that suffered atomic bombing, and based on this we have very strong national sentiments towards the total elimination of atomic bombs. And so we are very much committed to disarmament and nonproliferation. Stemming from this, we totally support and uphold the NPT safeguards system, or IAEA safeguards system, and in this background we tried to implement the IAEA safeguards. In the early 70s or late 70s when we started implementing NPT safeguards both IAEA and Japan SSAC were in a learning process. We did some things wrong. Sometimes good. Facility operators didn't know anything about safeguards.

Without any bad intentions they put something in front of the camera lens, so blocking a surveillance view. Or sometimes because of the unexpected circumstances the lighting went out on the spent fuel pool, without any intention. So these small things added up and we tried to create a kind of safeguards culture – what is important and what is essential to show the world that we are a benign country not intending to have nuclear weapons. Step by step this kind of cooperative approach and the attitude nurtured. We think that we cooperated with each other, not like suspect versus detective. We are coworkers to build an effective and efficient safeguards system and to apply what we gain through this experience to other parts of the world. Of course in the early stage we met some difficulties and some troubles to conquer but with this cooperative approach between the Agency and Japan I think we have come up with a good solution to that. And we, under NPT safeguards agreement, have so-called JCM, Joint Committee Meeting, for enhancing our cooperation. Also, I think we are the unique country – we have so-called SIR seminar. On this occasion with the cooperation of the IAEA and the government, the Nuclear Material Control Center hosts a seminar involving facility operators. What was wrong in the past implementation of safeguards? If there is a problem – such as lighting of the illumination – we explain what is really necessary. And also if there is any remedial method to overcome, we come to that. And through this I think the safeguards implementation has been improved over the years. So this kind of cooperative atmosphere is very important to address the safeguards problems that we encounter in implementation. And the facility operators, they are very ready to cooperate in some plutonium fabrication plants. The Agency has not so much money to construct a NDA equipment or containment method so the facility operator supplied and also developed – of course partly because of their material accountancy but some of the equipment is provided to the Agency with necessary authentication and this is used now for daily implementation. The cooperative approach is very essential – that is our experience.

Shea: I want to bring the technology into this and then we'll go around under rich here if we can. I wanted to come back to this point – in the early days of safeguards implementation, inspector would take with them the equipment that they would use. Most often, or more often, it wouldn't work when they got there and if it did it would either show results that they didn't understand - they're looking at lights flashing and trying to give the impression that they knew what was going on and if they got a result that differed from an operator declaration they would often kick the equipment to be sure – to wonder why it was different. And so there was a tremendous expansion of the technological capability during this early period. Even the chemical assay procedures that were used while often in laboratories they would talk about a tenth of percent accuracy, in the practice it was often five percent. So there were great differences that had to be resolved. The nondestructive assay work was largely the work of Los Alamos and no country was further ahead in looking for possible solutions than Japan. So maybe Jim can round this out and Rich can take us up into –

Hooper: I want to emphasize actually a little more. People tend to think of the evolution of safeguards in terms of the evolution of the legal and political framework in which all this occurred. They tend to forget how limited a capability – technical capability –

safeguards had in the beginning. When the Agency was called upon to implement comprehensive safeguard and there were increasingly complex implementation problems, the support program to a very large extent came to their rescue. And in doing so – I want to pay tribute to Jim and his colleagues at Los Alamos because it was really the work in the 1980s when the technical capability carry out real verification in very increasingly challenging verification circumstances that the work of Los Alamos came to the fore.

Tape: Thank you for that introduction. Before I get to the technical dimensions of what was going on in the 70s and 80s I'd like to provide a little more of the political and policy context. Roger raised a couple of points I'd like to bring out. In the US the divergence between military and civil nuclear programs really followed President Eisenhower's Atoms for Peace speech in 1953, with the Atomic Energy Act of 1954. At that time the US embarked on the development of civil nuclear programs and extensive cooperation with other countries around the world. The US I think provided the leadership regarding the voluntary offer during the negotiations of the Nonproliferation Treaty. In the mid 60s, 1967, President Johnson made the offer that nonmilitary nuclear facilities in the United States would be made available for IAEA safeguards.

So that was the political context. But to come to the technical activities and the experiences at Los Alamos, the Los Alamos safeguards technology development program was started in December 1966 when a gentleman named Bob Keepin returned from a tour at the IAEA. When Bob was at the IAEA he wasn't doing safeguards he was in the Physics Division or whatever it was called at that time. He became aware of the need of the emerging safeguards system to be able to do real independent verification of nuclear material inventories and state declarations and the like. He returned to Los Alamos, convinced the laboratory director that this was an appropriate thing for Los Alamos to undertake and convinced the Atomic Energy Commission to fund his program. When I got to Los Alamos, in the mid 70s, the program had begun to develop nondestructive assay equipment. For the IAEA the guidance was, whatever you developed had to fit under an airplane seat. The model was, the inspector took the equipment along, used it in the field, and brought it home. And as Tom has already alluded to, this didn't always work. It's actually rather challenging to do such a thing and to make it work.

So during this period, mid to late 70s and early 80s, a number of important things started to take shape, new ideas came in. One was the idea that perhaps one could develop in-plant instrumentation that could be left in the nuclear facility for use by the IAEA, perhaps sealed by the IAEA and so on. There was a great deal of resistance to this idea at first – the thought that it couldn't possible be used, couldn't get independent information from it – but people persevered. At the same time there were some very fundamental improvements being made in the technology. Howard Menlove was developing the concept of neutron coincidence counting for the measurement of plutonium, or in an active interrogation mode for the measurement of uranium. People like Roddy Walton and Doug Reilly were advancing the state of the art, along with many more that could be mentioned. Rich has mentioned the Member State Support Program. As I remember, in about 1977 there were conversations in Washington, about the desirability of developing a member state support program, the United States Support Program to Agency

Safeguards, known at POTAS. I think it has made very important contributions over the years, providing not only technology but also expertise. A number of so-called cost free experts supported by this program do tours at the IAEA and some of the people that have gone on those tours liked the work so much that they terminated their employment in the United States and went to work for the Agency. I think that's a very valuable contribution.

The other thing that I think was prominent in the period of the late 70s was the beginning of a very close and fruitful collaboration with our Japanese colleagues. This started with the TASTEX program to look at safeguards technology for the small reprocessing plant at Tokai, but it laid the foundation for a highly productive collaboration over many years. By the late 1980s the whole concept of in-plant instrumentation used by the IAEA came to fruition at the PFPP Tokai and other facilities. These activities were very important breakthroughs that have led to the modern concepts of using unattended instrumentation with remote monitoring.

Shea: I guess all of you, in each of your countries, have Member State Support Programs, which have been critical. Do any of you have any other remarks on this era before we move to the time of the noncompliant situations and the more current situations?

Casterton: Thank you, Tom. I think I would be very remiss if I didn't mention the very important role that was played by the Canadian Safeguards Support Program in the early days. It became an entity in 1976, I believe. As you know, Canada was pursuing a rather unique technology, the CANDU technology, which features the use of natural uranium and deuterium as a moderator, and it has a continuous on-load feature for the reactors and so it presented some rather unique – I wouldn't say problems – but certainly scenarios that had to be addressed from a safeguards perspective. During the early days there was a considerable amount of work done by the Support Program in conjunction with the IAEA in developing an effective safeguards approach, concepts, procedures, for safeguarding these heavy water reactors, the on-load fuel reactors. The Support Program was very much involved through cost free experts as Jim [Tape] mentioned. That was one mechanism. Another mechanism was to assist in the development of equipment because our system, our reactor technology, is safeguarded very heavily with instrumentation, a very thorough and competent containment and surveillance system, the elements of which were all considered in these early days - whether it be equipment for monitoring the discharge of the fuel from the reactor, equipment that monitors the movement of the irradiated fuel from the reactor core to the bay, that sort of thing. These early concepts were discussed – they're being improved upon today – but in that period I think the Support Program played a very significant role for us. We weren't involved in enrichment and reprocessing, but we certainly were involved in making sure that the safeguards system in Canada was as effective as it could be.

Naito: Jim already mentioned the Japanese support program and it was started in 1981. And through a quarter century support not only did we test the newly developed NDA to a specific facility, we also provided tests of new methodologies like the randomized

inspection approach or the complementary access provided under the Additional Protocol, to which you may refer later in this talk. So we made much effort to facilitate new ideas and methodologies and proved to be very useful both to the operator and to the SSAC and also to the Agency, how to implement these new ideas and encountering practical issues before they implement fully these new ideas and methodologies.

Hooper: Actually the near real time accounting, NRTA, had its beginnings in Japanese facilities during that same period.

Shea: The systems for support took some time to work themselves out. In the beginnings States would say, here's what we want to do for you and the Secretariat often times didn't have the understanding or the gumption to say, but that's not what we want. So gradually over time the idea of a user requirement was put forward, in which there was a kind of contrast then between the Secretariat and the State that was doing a certain amount of work. If the outcome was in accordance with what was agreed up front then it would be used. And that made a substantial advance. Roger, you want –

Howsley: Yes. Both Jim and Kaoru have mentioned the technical aspects of the support programs and the very fine work that was done on the instrumentation side. We had a smattering of that over the years with enrichment monitors and a variety of things, but the UK decided, the DTI decided, that they would put the resources available under the support program largely into training and familiarization visits for inspectors. I think that was very important and over the 20 years or so that the support program has run, I think we've probably trained the good chunk of inspectors that ever worked at the Agency. The reasoning for that was two-fold. First, that we operated a very wide range of fuel cycle facilities, which meant that inspectors could come and get first-hand, friendly experience going round some of these plants that they may not have done before. And secondly, we internally were having cultural issues around having inspector, not so much with them visiting our plants, but for the operators to understand what on Earth they were doing and why they were there. So the more people they saw coming around the plants, and interacting with them, the more they began to understand what this strange world of international safeguards was all about. So that was really the beginning of it and that then moved on to something called the 'proliferation pathways' course, which is where we had our technologists begin to look really from the point of view of somebody that wanted to divert material to say what would be the indicators if somebody was diverting material. And so we developed a course around that, which I think has run for quite some years. So that was the substance of our support program.

Tillwick: I think if we look at South Africa's case we've only joined the support program in the last few years. Now what we've tended to do is focus on new developments, in particular the Pebble Bed Modular Reactor, we have 4 support program tasks. Some have already started and some need to start. I can mention for example design information verification as well as flow verification and spent fuel verification. But these tasks will be done in close cooperation with the Member State Support Program because designs need to be forwarded at an early stage and we are looking forward to progress on that in due course.

Hooper: In 1991 of safeguards making enormous strides technically, but operating within a stable political and legal framework, everything began to change. And this is a result of 3 circumstances that were almost concurrent in time. The first of those was the end of the Gulf War, and the UN Security Council Resolution that ended the war mandate the Agency to the disarmament of Iraq in the nuclear area. Fairly quickly thereafter the inspection process got underway and very quickly began to understand the size and extent of the Iraqi clandestine nuclear weapons program. In the summer of 1991 as you already heard, South Africa took the decision to – it had already dismantled a nuclear weapons program – to join the NPT and very rapidly concluded its comprehensive safeguards agreement with the Agency. And from that follow the so-called completeness inspections in South Africa.

Not long thereafter the North Koreans, the DPRK, finally concluded after about 7 years their comprehensive safeguards agreement with the Agency. And because this comprehensive safeguards agreement was concluded in the aftermath of the S. African experience where the precedent had already been set that the Agency upon receipt of the initial report not just the correctness but the completeness of that report. These inspections in DPRK very rapidly ran into difficulty. The difficulty culminated in February of 1993 with a special Board convened to consider a Secretariat request for a special inspection in the DPRK, the Board concurred, supported the Secretariat in that request, the South African's then proceeded to start a process of withdrawing from the NPT, which was only stopped at the eleventh hour through an agreed framework and of course the whole history that has evolved since that time.

In the fall of 1991 then Director General Blix expanded SAGSI from its then traditional size of 14, to 20, and mandated SAGSI to make recommendations to him on how the safeguards system could be strengthened and made more efficient. SAGSI carried out its work through the course of 1992, and in April of 1993, in SAR/15, reported its recommendations to the Director General. The Director General then, in summary form, past those recommendations on to the Board, this was in June of 1993. The Board's reaction to this was to instruct the Director General by December of that year to come back to the Board with a proposal on how the Secretariat would proceed to define the technical, legal, and financial implications of SAGSI's recommendations. That proposal went to the Board as requested in December of 1993, the Board then instructed the Secretariat to proceed with that work, and that was the beginning of what became known as Programme 93+2. And all then that has ensued from that. I would at this point invite the panel to provide their comments and their personal experiences regarding their participation in that whole era, the new era of safeguards at the point in time.

Casterton: Well, thank you, Rich, but you have to remember that you're speaking to a much younger group on this side of the table. I mean undoubtedly we all had some experience at that time but the extensive experience you already had and the knowledge you've been able to acquire was unsurpassed.

I can say that, yes, not in a SAGSI environment, but during that period of time there was a lot of activity going on and, as you mention, there were certainly situations that spurred

this increased activity; some serious developments that had to be addressed. SAGSI did play a significant role in here. I do recall that at that time the SAGSI Plus Group – a Canadian representative, Mr. Mark Moher joined the SAGSI Plus to be part of this exercise. I think in one respect as a current member of SAGSI, it's gratifying to go back and look at some of the contributions SAGSI has made over the years and the way that the Secretariat has actually utilized experience and expertise in SAGSI membership to come up with ideas that could assist them in strengthening the safeguards system. Of course it won't work unless the Secretariat agrees with the general approach here and together in a kind of a team environment, we move forward. So I think that was very important. During that period of time it was very dynamic; in 93+2 I think in the Canadian situation in the – again probably through the Support Program route – we were quite involved in specific elements of 93+2, helping to look at areas as they apply primarily to our own reactor technology. Again in that area we were involved in – if I'm not jumping too far forward – the concepts that emerged post 93+2, sort of in that period but developed a little bit later than that, dealing with integrated safeguards and that sort of thing; not only effectiveness, which was certainly the major drive in the early 90s, but then moving from effectiveness also to efficiency. Efficiency without undermining effectiveness. It was a very interesting period of time. As I mentioned, my involvement was rather unique and it became intensive in 1996, when I got to the Agency. So the 93+2 exercise I think it adds up to '95 but I think it took longer than that period of time. It should have been 93 plus a bit more. But in '96 when I got there we were already working in Committee 24 and again we played a unique role there. I remember my Ambassador at the time was Chair of Committee 24 and I think he needs to be commended as well for the work he did in getting the work of the committee finalized and completed successfully in a very short period of time relatively speaking. It goes back to a point that I think I'll make a little later when we get perhaps to future challenges or future directions and that is, it's amazing what can happen when there's political will to achieve a goal, backed by good sound technical expertise. Then progress can be made, rather dramatic progress can be made to address problems that confront us in this area. I think as we look to the future we should keep that in mind because this was a very unique period and being able to contribute to it was very gratifying.

Tillwick: I think that if I talk in terms of South Africa's experience, we had the previous SAGSI member who was actively involved in 93+2 program. But we also added to strengthening measures, the environmental sampling and the unattended remote monitoring field trails, which were started during that period. And we participated actively during those field trials and brought one of those – I'd say both of those – to a very successful conclusion. Because we did have enrichment facilities and sampling could be taken at different distances, locations, etc. and could contribute very valuably to the field trials support program.

Howsley: I think in the UK our experience mirrors that of Dieter's in that we provided a good deal of support I think in terms of environmental sampling and other things. For us the 90s, the mid-90s, were dominated really with bringing on to line the thermal oxide reprocessing plant. And of course we had Euratom safeguards on that and other facilities at Sellafield and elsewhere in the UK. And that for us was an especially busy time,

trying to get all of the systems to work and to meet all of the commitments we'd made in terms of safeguarding those plants.

Naito: In the case of Japan 93+2 was also a very important issue and also contributed a lot in the Committee 24 deliberations and my predecessor in SAGSI was involved in that. So I don't have much direct information on that but this is a very unique area for the Agency because in the traditional safeguards we dealt with nuclear materials and also classical nuclear material accountancy. But now in the realm of undeclared activities, and nuclear materials, this is more on the declaration and also the activities not directly involved with nuclear materials. Japan ratified Additional Protocol and as one of the first countries with full-developed fuel cycle activities. To devise the legal tool to implement this kind was a kind of challenge. Because in the past the normal regulations dealt with nuclear material, now the Agency has the access right to anywhere. It's a kind of change of mind. So that faced a challenge for the lawmakers to adopt the domestic regulations to meet this requirement under the Additional Protocol. So this is a new challenge, a new experience, implementing complementary access, so as I said before, we offered the Agency to do field trial of Additional Protocol implementation. And we gained lots of experience beneficial both to the Agency and the SSAC. And so through this we gained a lot of lessons learned and so this made the smooth implementation of the Additional Protocol. And also we held the kind of briefing to the facility operators and also the sensitive equipment manufacturers about what to declare. This kind of preparatory work also helped to smooth implementation.

Tape: Well, as my colleagues have already said, there was a great deal of activity going on the technical side through the support programs and other mechanisms of providing technical support for some of the new tools that were being proposed, such as environmental sampling, the broader use of information acquisition and analysis, and the like. In a sense this brought out of the shadows something the United States had long been interested in, and that was the detection of undeclared nuclear activities. The US as well as other countries had never placed all of its reliance on safeguards - I think this was a point Jim Casterton made very early - safeguards are but one cog of this whole nonproliferation regime, and one part of that is trying to understand what countries are doing and not telling anyone about. So it brought some of those methods out of the shadows and into routine use in the IAEA. The contributions from all the Member States have really significantly strengthened the safeguards system through this period and I think, as we'll get to, it's still a work in progress.

There's another important element from the US perspective that I'd like to bring out from this period. And that's the end of the Cold War and the breakup of the former Soviet Union, and in particular the declaration of weapons materials as being excess to military uses. For the United States in I think 1994 if my memory serves correctly, the commitment to place some of these materials under safeguards, to make them available through the mechanism of the voluntary offer agreement for IAEA verification, led to a very significant change of having international inspectors coming to our former weapons plants to inspect some of the most sensitive materials that we had in our program. From my perspective this went very successfully and then led to one of the most interesting

projects I've ever worked on, which was the Trilateral Initiative to explore the technical, legal, and financial issues surrounding IAEA verification of excess weapons materials, some of which are in classified forms. I had known Tom Shea for many years – I must say I got to know him much better during that period –

Shea: I recall one time you said you were spending more time with me than you were with your wife because of the program –

Tape: It was not much of an exaggeration –

Shea: I think we'll come the question of future and arms control related measures when we consider future possibilities, but in relation to the Additional Protocol, before we leave that, I wanted to just mention that I know in Japan one of the outcomes has been to create a world-class laboratory for environmental sample analysis. I also know Japan has run a number of workshops, particularly regionally focused, to get other countries to conclude their Additional Protocols. I also know that the United States is taking steps toward implementation – we all wish that would come about more rapidly than it has – legislation's now been passed but there's still the enabling regulation and whatnot that will be necessary before it can enter into force.

Casterton: Jim [Tape] introduced a preliminary discussion on the context in which this was all going on as well. I think that's a very important element. During the same period, somewhat for similar reasons, there was quite a focus on nonproliferation and there was considerable activity going on in other mechanisms for instance, there was a groups of States that were interested in pursuing full-scope safeguards as a condition of supply at this time. There was a rejuvenation of what is commonly referred to as the Nuclear Suppliers Group from that period of time. We also can't forget that in the mid-1990s, in 1995, there was the permanent extension of the NPT Treaty. I think that's very important to again establish the context, because I think efforts to address challenges to nonproliferation, or threats of challenging to the nonproliferation regime, are multidimensional and safeguards played a very big role there - strengthening that element of it. But I think that the whole issue of needing to do something was on the wider political agenda and it manifested itself in all these other activities. And to the extent for instance that when you were at an NPT Conference and you were discussing safeguards issues or export control issues, you always had a positive message there, a message that said, yes, we have to do something, we have to strengthen the system to respond to these changes. And the positive message was there was really good work being done in the IAEA with the Member State support programs, with the help of SAGSI, with the help of others, to address and do things in that area. And really good work was being done in other areas of the regime to try and address and improve the situation. I think it was a very, very unique period of time.

Hooper: I'd like just for a couple of moments to underscore some of the things that have been said with regard to the successful performance of Programme 93+2. The name of this thing tended to convey a deadline. And that is that the programme had it's beginning in the Board decision of 1993. The goal of the programme was to produce a final report

to the Board of Governors, prior to the 1995 NPT Review Conference. That deadline was met. But as the work continued, the name continued and so of course it became the butt of a lot of jokes. The work of 93+2 itself was carried out primarily in the year 1994. To give you just a flavor of the contribution of Support Programs to this work, I'll say at the beginning that we never, ever asked for anything that we didn't get. But three particular examples of the contributions that they made. These various ideas and concepts had to be tried, had to be rehearsed and the trials that went on were of course hosted by Member States under the auspices of the Support Programs. Three particular areas. These ideas of complementary access, very rapid access, to locations and facilities, sites, and other locations. Three States participated in that. They provided us the first examples of what became known as expanded declarations and then cooperated with actual access trials. This was Canada, Sweden and Australia. We also – while we had a lot of experience with and were convinced of the viability of environmental sampling as a safeguards strengthening measure – we needed to conduct a series of field trials in diverse environments, in diverse facility circumstances, so that we could put that information in front of the Board and to convince them that this was a new technical safeguards measure and that it was objective. And so there was a whole series of these sample collections that went on all around the world. They went on in South Africa, they went on in South Korea, the US and Japan, Sweden – I think there were a total of 13 all together. And finally as things had evolved by no means least was the development of what has become known as a physical model. This idea of a physical model, a model that would attempt to identify all the known process for carrying out every step in the fuel cycle, to characterize all of those processes in terms of the indicators of the existence of those processes, so that every pathway, known pathway, to the production of weapons-useable material, could be characterized in terms of some sequence of well-characterized process in terms of the indicator of their existence. This work initially was done by, was supported by, three experts, real experts. One from the US, one from France – no four – US, France, Australia, and the UK. Now as time went along the, in an attempt to obtain some sense of closure, the very large extensive advisory group meeting organized and involved a much broader group of states to review what we had done and advise us regarding further improvements. That is just an example of the importance of Member States and the Support Programs in particular in this whole process.

Shea: So we now come to the point of the challenges from getting the Additional Protocol into place and strengthening the nonproliferation regime, the changes, the concerns about the spread enrichment technology, concerns about nuclear terrorism, proliferation in Libya and DPRK, Iran, all of those issues which are challenging the viability of the system and its capability to respond in ways that bring about end results. This is obviously an ongoing situation. Libya obviously came forward in a manner not unsimilar to that of South Africa of making a decision that it would stop its program and open itself up. North Korea's been a very different situation with the Six Party negotiation process underway and at the moment things looking bright again. I hope it will be a successful resolution in that particular case. The case of Iran is still rather cloudy I'd say. It seems to me that having been involved in safeguards since the early 70s up till today that the technological capabilities have made enormous strides over that period and the recognition to perhaps the least likely path the nuclear weapons is to divert

from a facility under inspection than to do something on the side if at all possible. Still the strongest point that we have going for us is the unanimity of the international community that proliferation is dangerous and that controls need to be put into effect and sustained that will keep us into the future. So I think at this phase then we can look at this sort of contemporary era – where are we today. We'll postpone the questions of arms control issues, the Article VI kinds of concerns, possibilities that might arise, until the next round. Could you kindly then now take a perspective on where are you today. Now you're looking at, in your role as SAGSI members, at resolving some of the practical matters of implementation while the Agency safeguards department still focuses on the proliferation issues and security activities relate more to physical protection, illicit trafficking and the like.

Casterton: Thanks, Tom. If we're going to focus on today or what we've been focusing on over the last say 5 years, I think you're right that there has been an awful lot of change in terms of technical competence, technical capabilities of the Agency, but I think there has also been a considerable amount of change over the last several years in terms of the Agency's approach to safeguards. The approach to a movement from basically a facility-specific safeguards system whereby you were applying for the most part a uniform system of safeguards at different types of facilities no matter which country those facilities were located in. And that led to a situation where – I think you alluded to it earlier – that the amount of safeguards effort in a State was dependent upon the size of its program and that led to a lot of the Agency's resources for safeguards and verification being spent in Germany, Japan, and Canada, because we had large programs. I think the shift now is with some of the tools that the Agency has and a shift in outlook is to move to a more State-level approach. Kaoru mentioned that in his opening comments; that trying to look at a bigger picture, trying to assess the significance of safeguards, evaluate States' performance, determine the amount of effort you have in a State from a verification point of view, on the basis of information analysis, everything you know about the State – when I say you I'm talking about the IAEA because they will be the ones determining this effort, because they still have the responsibility of having to draw an annual conclusion about what their experience has been in implementing safeguards in that State, in a given State, over the course of the year. I think all of this is done within the context of significant changes to safeguards culture and I think that's one of the things that's certainly being pursued now. In order to move, it's not just saying, yes, we are implementing the State-level approach. It's going to take a while to fully, I would say, optimize that new perspective on safeguards and I think that's one of the challenges the Agency has today. There has been a lot of effort put in place through SAGSI, through other mechanisms, to try to ensure that the safeguards system is responsive to, and continues to be responsive to, challenges and threats; continues to be effective; continues to provide credible assurance. This is a major element of this - to develop and implement a State-level safeguards approach. And for those States that have signed the Additional Protocol and have received a broader conclusion they are moving to what is called integrated safeguards and again that should be undertaken at a State level – so a State-level integrated safeguard approach such as Canada is in the middle of pursuing at this point in time. We received our broader safeguards conclusion the first time in September 2005. So, in a Canadian context, we have since that time been working diligently with

the Secretariat to try to move to the implementation of a State-level integrated safeguard approach. Now that has to be done incrementally; that has to be done along agreed priorities; it has to be done taking into account available resources, that sort of thing. And so as more and more countries achieve this broader conclusion, the Secretariat is going to be faced with re-orienting its safeguards approach in those countries over the next little while and that's going to be a major challenge. And I think one of the things along with safeguards culture that will have to be addressed is that safeguards will have to become more adaptable, for want of a better word. It will have to differentiate more than it has in the past I think, my own view, between safeguards implementation in particular countries again based on analysis. It's not discriminating - not saying that we're going to discriminate one country against another country. But it's recognizing that there is room to have safeguards applied differently between countries, because of different reasons - State-specific characteristics, fuel cycle characteristics, whatever the case may be. In order to make that work what has to be done is the whole process has to be transparent. States have to know how the Agency is going to derive its safeguards conclusions. States have to know the processes that are involved, whether it's the State Evaluation process. They have to know the processes to determine effort in individual States. There's a lot of work that has been done in the Secretariat on this up until now. It still needs more work and I think that's what's happening. I would say that that's the current situation in the Agency.

Shea: So in a way this is similar to the 70s when the whole system was being framed and parameters and working arrangements were being established. In that time it was often a case where countries that were very cooperative provided the basic experience, which was then used to go into situations in which countries were less cooperative. So hopefully this will work –

Casterton: And I think cooperation is still the key. It's not just an obligation that's placed on the IAEA. It's also cooperation and commitment by Member States.

Shea: Well and again the norms that the extent to which the community of nations establishes an understanding that a certain practice is expected and is common that's the strength of the overall system then.

Tillwick: What Jim has said in terms of the State-level approach this is a very good way forward for improving the effectiveness and efficiency of the Agency processes. If we take for example sites where you've got a fuel manufacturing plant, a PWR and a HEU fuel manufacturing plant bordering, basically bordering. Now to have the same criteria-based approach to one plant or the other doesn't make much sense. It's the same proximity. The State-level approach will address that and will bring in a lot of efficiency within this process. Now in terms of implementing the State-level approach I remember distinctly when we had many discussions with the Agency in terms of the new safeguards approach for the Pebble Bed Modular Reactor that we actually wanted an approach under traditional safeguards. Reason being that if this modular-type reactor is being exported to countries which are still not under Additional Protocol - traditional safeguards, that it can be basically exported to those countries. At a presentation this week in terms of the

Pebble Bed safeguards approach, being in South Africa, going into integrated safeguards. But looking at the approach being presented it was more or less a criteria-based approach as presented. The transition to integrated safeguards wasn't presented as such, which shows us that within the Agency the development towards the State-level approach needs to take more effect as well. And I think it's a learning curve, it's a steep learning curve for everyone, it's not an easy process. I think many of the SSACs worldwide will have to go through this learning process as well. Therefore, as Jim has alluded to the fact that transparency and the cooperation and enhanced cooperation with the SSAC, and particularly for the Agency to bring it back, what does this all entail and how does this process work, would be very beneficial to the strengthening of safeguards.

Howsley: I would agree with everything that's being said. I think that the Agency now increasingly has the tools to do the job. No doubt we'll come onto the budget at some later point, but notwithstanding that, the Agency is always going to be resource limited, and it has to take choices. And my colleagues talk about information-driven decisions, which is really another way of talking about risk management which is what I think it is. And all organizations have to manage risk to some degree or other. And it's for the Board of Governors and others to decide on the governance framework and the level of risk that it's prepared to accept. I think we're entering a phase in SAGSI which – SAGSI has very much a technical mandate – but I sense that quite a lot of what we feel we ought to be doing at the moment is less technical and really helping the Agency improve some of its processes. Maybe because of some of the experience we have working in commercial areas or other areas. And in the last couple of years we've been encouraging the Secretariat to map out all of the processes because, as Jim said, if you are going to start to differentiate between States in terms of the safeguards approach, you have to explain the processes that you are using. And I think it's entirely possible to do it. It's a standard feature of any commercial organization if you're using the modern jargon of 6Sigma or whatever else the starting point is to map out what you do, to see how you could improve your processes. And I think we've made, the Secretariat's made good progress with that. So I think it's very much about – I think we are entering a slightly different era where the Agency's going to have to learn to digest and analyze information quickly and effectively and I think it's a very exciting time. I think if they can get the budget sorted out in the next 2-3 years ahead – because I think there's no doubt the budget will have to increase – I think the Agency's got a really good time ahead of it.

Naito: I'd like to further explore what Jim said. Thanks to the integrated safeguards that have the optimal combination of traditional safeguards tools and Additional Protocol tools, and attained efficiency without losing effectiveness, so there's a reduction in inspection activities. But, there's a lot to be done still because currently lots of inspection resources go into benign countries like Canada and Japan, while the suspicious guys still are out of scope. So when we finished the safeguards criteria review, Mr. Elbaradei came to speak to SAGSI and he mention so-called intelligent safeguards. What is intelligent safeguards? That means you put your resources where the real risk lies and we have to devise such a method and methodology and this is differentiation without discrimination and I have already left SAGSI so this young new generation should follow this approach, how can you attain differentiation without discrimination. Another idea coming from

Roger is infrequent, intensive verification. You may not often receive IAEA inspector but when he comes it is very intensive so that kind of new idea should move further followed, and so I look forward to the outcome from the new SAGSI group.

Shea: So the second point was Roger's question of intensive, infrequent inspection, which takes the place of a routine inspection regime over a period of time and allows confident decisions to be made. Jim, would you like to round out this round –

Tape: Thanks, Tom. When I joined SAGSI, I was afraid that I was getting involved with this group at a time that might be relatively boring as compared with the previous decade of 93+2 and all the new additions. I was quite envious of my predecessors Ted Sherr and Frank Houck. But I very quickly learned that I was wrong and in fact I've come to believe that the period we're dealing with in SAGSI now is every bit as interesting and exciting as the 93+2 and strengthening period, and perhaps will be equally significant. My colleagues have already touched on the various aspects of this such as the State-level approach, and differentiation without discrimination. These are fundamentally different ideas about the way to apply safeguards. I think the degree of change remains under appreciated in capitals and in the Board, but I believe that it's absolutely essential to do this and to do it well. I'm very glad that SAGSI is engaged in this, because there are potential serious downsides if we can't work with the Secretariat to find ways to adequately convey what these changes mean. There's the risk that Member States will lose confidence in the system if in fact it becomes an ineffective system the confidence indeed will be eroded. But I'm optimistic. I think it can be done. I think there are very many smart people working on this – SAGSI colleagues and the Secretariat and other experts in international safeguards, and I believe everyone is committed to make this work and make it go forward.

Hooper: I think we've reached a point where as we look to the future and as some of these challenges get met that the threats, the things that stand on the horizon that threaten progress is not do we know what to do – I think mostly we know what to do. That doesn't mean it's easy to do but we know what to do. The threats today sound like more mundane problems but difficult all the same and they come down to resources, but not just financial resources, the human side of this enterprise is in crisis and how these circumstances work themselves out in the next couple years in my mind is going to go a long way to determining at least the short-term success.

Shea: Well we have now – before we move into the future challenges – we have situations today where nuclear power is expanding dramatically in various parts of the world, I think there was one of the papers at the INMM Conference that took place this week indicated that there were 28 new plants under construction and 202 around the world in various stages of planning. All of these require manpower at unprecedented levels. In the meantime we see in the industry a kind of bi-modal distribution, particularly in the United States where we had a very aggressive nuclear program up to the Three Mile Island accident and then gradually walked away from it and now coming back and so the aging process we is that so many of the experts are soon to move on. The programs in universities in the United States have strengthened quite a bit but there's this

remarkable gap in the middle of 40-year olds in particular. So there are tremendous opportunities but I'm worried in terms of the Agency's ability to attract and maintain and retain a very competent staff while a) there's shortage somewhere else, and b) market-driven increases in many countries around the globe. How the condition can supply. Particularly with the funding arrangements for the IAEA which of course require political consensus which is difficult to attain and to see any change of major dimension requires inordinate effort over a long period of time to reach agreement and of course you have to compete for funding through the national treasuries arrangements. So I think in terms of whether we look to the future to continue to support or whether in fact the current funding levels are somehow considered as a magic number which should not be exceeded, those considerations can have in my mind only a progressively destructive effect on the underpinnings of the institution and its ability meet the mission we have entrusted to it. Jim –

Casterton: Thank you, Tom. I think certainly the situation we find ourselves in today and the environment in which we have to conduct our business in the safeguard area – you mentioned resources and the issue that the Agency has to look for greater and more reliable financial resources, you mentioned the staffing situation. We're in a period of time where we're losing a lot of people that have contributed for a long period of time and we're creating a bit of a vacuum. The challenge is to ensure that we have brought on the next generation of safeguarders or nonproliferation experts and specialists. I think, though, that the one thing to keep in mind is that this is not just something that is affecting the IAEA. This is something that is affecting nations, countries, national regulators. For instance, my own organization, the Canadian Nuclear Safety Commission is Canada's national regulator and in the context of safeguards as I mentioned earlier the State System of Accounting and Control. One of our challenges is certainly to ensure that Canada continues to have an appropriate regulatory framework in place to deal with regulating the nuclear industry and contributing internationally to efforts to strengthen safeguards as an example. In our environment we too have to deal with issues associated with ensuring that we have appropriate resources. We also have to deal with the fact that we're trying to compete for new talent with our national industry representatives. We're trying to compete for new talent with the IAEA. It is a very difficult scene or scenario that we find ourselves in. But I am encouraged that in my own particular area we have been rather successful in attracting young, recent graduates into the safeguards side of things. Our obligation and our challenge is to ensure that they see that operating in this field is rewarding, beneficial, has long term prospects - if they're in the neighborhood of seeking long term prospects. And I think one has to look at innovative strategies for attracting people - new blood. On the resource issue, it's complicated because there is obviously a very strong political dynamic to the whole process, the Agency being, you know, a UN organization. It's going to continue to be difficult. Progress has to be made in one way or other in order to ensure that the Agency has at least an appropriate level of resources to continue with its safeguards activities. But I think to balance that as well there is a need – as we talked about earlier – for the Agency to perhaps reinvent the safeguards program from a facility-oriented program to a State-level program. There's an expectation that that will result in some resource savings. I'm not so sure. Maybe it's just too early to tell the extent of the resource saving because – I think it was Roger that

mentioned earlier – the Agency is honing its capabilities to be information-driven. So field activity may be somewhat offset by increased analysis activities. Very, very challenging times in these two areas, but I guess whatever happens in the Agency environment is going to be a product of what happens within national governments. Support for increased resources for the Agency and safeguards is going to take a bit of time to come by and I think currently the Director General is trying to address this. As I understand coming from the last Board meeting he indicated that he was going to take a specific initiative to try and look at the future of Agency resources, the needs and how to go about attaining them.

Tillwick: I think there was a note from the Director General to indicate aging resources, particularly laboratory equipment which need to be replaced because you cannot be more efficient and carry on pressing out the last drop of old equipment. And this has to be addressed. How it will be addressed will be a challenge going forward. But in terms of human resources now various Member States have the same problem – I think the aging population is with us and it's all around. We tend to address the aging population – I know the Agency's got a rule in terms of retirement by age 62. We've got a retirement age of 65 but presently I'm employing people up to 68 – and we have a Pebble Bed permanent appointment up to 72. We employ the people to do skills transfer, to get the youngsters in to learn from them, and this has worked very well. What we've also tended to do is look at equity, in particular ladies, or women coming into the safeguards environment as well. We've been very successful. Unfortunately now two of them have joined the Agency so the Agency is benefiting as a result of that. But I think equity is an important issue which the Agency is driving and we in our country are also driving equity from that perspective. If I look at the very young generation – I've got a son who will probably start university next year and he's indicated that he may go into nuclear physics, so may join in my footsteps in safeguards somewhere in the future.

Now in terms of the financial resources, financial resources is a difficult thing. And I think in terms of extraordinary budget and Member State Support Programs need to be better focused and structured. When I say it needs to be better focused and structured, there are many of the projects which go into what we call equipment development as well, but the actual safeguards system itself and the soft processes need far more attention as well. And I think this in one area that could be expanded on.

Howsley: I think it all depends on what your vision is for the nuclear industry. I don't think anybody thinks that the nuclear industry is going to solve all of the world's climate change problems. It will make an important contribution for at least the next 60 or 70 or 80 years with the new round of reactors. And I think people underestimate generally how "energy" across the world is going to mean "electricity" across the world. And electricity is going to be used and is going to be needed for both a hydrogen economy in my opinion, in terms of generating hydrogen, and it's also going to be required increasingly for desalination. Those are my expectations, so I think the nuclear industry itself is going to grow very significantly. Now as part of that vision I think we ought to be able to say about our industry that it's both safe, secure, and safeguarded. Those are the three Ss that go together. And I don't know what we spend on safeguards as a percentage of global

nuclear turnover- it would be interesting to do the calculations. I mean if you reckon that turnover – I have no idea what it is – but if you said it was 50<sup>2</sup> billion pounds or dollars – there's a bit of difference I know – but if you said that the safeguards costs were half a percent of turnover that would give the Agency a budget of about two hundred and fifty million pounds or dollars. And I think the current budget limit for the Agency – my experience of running budgets not much smaller than that has been that the problem you have is getting the budget changed. The absolute value of the budget if the Agency has been spending 500 million dollars a year, that would be the norm and people would accept it. But it's when you go from 500 to 520 to 540 to 580 that people get concerned. And my own view is that the people on SAGSI and the Secretariat and the Board of Governors, they are playing a leading role globally in terms of corporate governance, because if they aren't providing the right resources to the Agency to do its job, then nobody is. And I've thought for many years and have said for many years that I think the Agency is vastly under-funded. And I think we should be looking at something like a 3 or 4 fold increase in its budget, particularly with the sort of renaissance of nuclear power. I don't think operators should be paying it directly- I mean they do indirectly through profits they make or other contributions they make to government, but it really is small beer compared with the benefits you get from it.

I think some of the other things we're going to see looking forward, the nuclear industry is still in my opinion in a very, very early stage of industrial development. It reminds me of the car and the airline industry in the UK going back into the 50s and 60s where you had your own national models that were State controlled. I don't think there's any place for that in the future. I think a number of large multinational corporations are going to emerge just as the General Motors have and the Fords and the other companies, who are going to begin to take control of our industry, as they should do. And I think that will have important ramifications for the Agency because with a growth of multinational ownership of companies, and companies that see the electricity produced by the reactors as being the end result, and not getting too excited about the technology on the way to the end result. I think that will have a significant effect on the way that information is made available. I think it will introduce a new level of corporate governance because if you're sitting on the board of a multinational organization that runs reactors in this country and that one and that one and that one, you're not going to have anyone play around with those plants in terms of diverting material or anything else. And we've seen historically how whistleblowers can provide very useful information about nuclear programs. And I think we're getting to a stage in the evolution of the industry where the amount of information that's available is going to make the world a very small place and it's going to be increasingly difficult to divert materials and to divert technologies in my opinion.

I think there's one other thing that needs to be done and I alluded to this in terms of the UK position 20 years ago, and that is that I think all nuclear weapons states have got to completely separate their military and civil cycles and I think that needs to be a condition of trade. I don't see how you could have any, any mixing of those streams because if the

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<sup>2</sup> Audio says 5 billion but 50 billion was meant.

ultimate ambition is to grow the civil component and shrink the military one you can't have the confusion of those two being together.

Naito: As the nuclear energy expansion is expected the Agency definitely will face the people staff resource problem. But this is not unique to the Agency as Jim pointed out. The Japanese government and industry are also aware of this. And some of the activities are already initiated. One is knowledge management and also how to approach the potential workforce to be brought into this specific area. And two government agencies, MEXT and METI, are already securing some budget to address this problem. Vitalizing the academia, especially related to the nuclear field. In the past, thanks to some public perception, nuclear engineering lost appetite so it was renamed. Instead of nuclear engineering it's quantum engineering or something like that. So no one knows what about this quantum engineering made it more attractive. So this kind of approach and also outreach is important and the Japan Atomic Industrial Forum initiated a kind of meeting place for the industries and the students to find job opportunities and so forth, to familiarize them with what these specific companies are doing in a particular area. And so I think in order to attract people to the Agency, especially in the safeguards area, this kind of outreach activity is important. And in this Annual Meeting of INMM, there was an IAEA representative to do such a thing. Also last November in Tokyo, Mr. ElBaradei came to give some commemorative speech after receiving the Nobel Peace Prize, and he tried to meet young people and I think the idea is stemming from this awareness of challenge, and new challenges. And after the talk there were some questions and answers and one of the university students stood up and asked about, what kind of qualification the Agency seeks for future candidates of the staff. And Mohamed said, just like you. So that motivated the people's attention and interest. So I think this kind of outreach is very important to make use of every opportunity to familiarize what the Agency's doing, especially that area of safeguards. And with regard to "Is nuclear energy expansion possible, feasible?", I think there's several questions to be addressed or solved. One is the waste issue. In Japan we are looking for the final disposal of the vitrified waste into geological repository but so far not successful. So we have to do something to address this and as Roger said, the public acceptance is very important so the securing, safeguards, security issues should be secured. So we have to do our homework to materialize this possible nuclear energy expansion.

Tape: Like Roger I believe that the Agency safeguards budget is smaller than it should be. But unlike Roger who put this in the scope of the commercial activity that's being safeguarded, I would put it in the context of its national security contribution and the international security contribution. It's actually a smaller fraction of defense expenditures around the world for example, and yet it makes a very important contribution to national and international security. I used to make the argument in a way that's familiar to people that study physics in terms of orders of magnitude. The current safeguards department budget is in an orders of magnitude sense 100 million dollars a year. And so you ask yourself the question, should it be an order of magnitude smaller than that, which would make it 10 million dollars a year, and you say well of course not, absolutely incredible. And then you ask should it be an order of magnitude larger and reach a billion dollars a year? I don't think that's incredible. Now obviously you can't

start there – Roger made some very important points about the difficulty of moving from where you are now, but I think the bias of the Member States needs to move toward increases to meet new challenges that are coming along.

In terms of the human resource question, it's extremely important, but I think those of us who have the grey hair around this table need to remind ourselves that we were young once too, and I like to think we were pretty competent in those days and we actually made some contributions when we were young. So all is not lost because there is this gap. I think there are some capable 20 and 30 year olds coming along that are going to pick up the baton, with the few middle aged professionals that are out there, and carry safeguards forward. So I'm pretty optimistic provided we pay attention to this problem and I think we all are, individually and in the Agency as well.

On the question of the growth of the nuclear industry I am very much focused on the notion that it is the problem of managing spent fuel that needs to be fixed. I'm also very much convinced that there are technical solutions to this problem. I'm particularly interested in the pursuit of research that would allow for the recycling and then transmutation of these wastes, which would not only would help with the waste management problems in a direct sense, reducing repository loads, reducing the lifetimes that the repositories have to perform adequately, but would also have the potential of making enormous contributions to the nonproliferation problem by allowing the take-back of spent fuel and the management of spent fuel so that we're not contemplating storing spent fuel all over the world at every reactor. I think that it's extremely important.

Hooper: I think that the human resource difficulties of the Agency and I agree with the point that Jim just made and that is that there are a lot of young people coming to this business. But the Agency clearly at this time needs to take some actions to mitigate current problems. They have recruited people really throughout their history on the basis of a model whereby they were looking for mid-career people. These people at the time of the tremendous growth of the Agency's staff in the aftermath of the entry into force of the NPT, there were a lot of these mid-career people that were available. And the growth of the Agency that occurred during that period of time – the addition of these mid-career people – they've all come to retirement age at the same time. And so the Agency right now, the department of safeguards, really has a tremendous loss of institutional memory. What are the kinds of things they could do to mitigate this in the short term, as some of these people are brought along? There is, first of all they have to change their recruiting model. The training model also has to change and I see the Support Programs having a fundamental role to play in this. Contacts with universities, partnerships with universities, add nuclear safeguards type of curricula, to graduate programs for example. There are lots of things that could be done. But there's actually a very substantial reservoir of vast experience in the retirement community in Vienna. Immediately available people that have a tremendous amount of experience and to establish a mentorship where these people are the made available to these younger people to bring them along and mentor them and bring them along faster than they would otherwise are things it seems to me the Agency could do to mitigate these short term effects.

Shea: I think there are other things that are perhaps going to be necessary and when SAGSI agendas are scheduled in the future there might be a topic. I can think of two things that go beyond. One is that investing in student by giving scholarships to undergraduates or fellowships for graduates training with a requirement for a certain period of service upon completion – something that is a relatively modest investment in the short term and in the long term can provide immense benefits. Another is the National Nuclear Security Administration in the United States has a Nonproliferation Graduate Program intern arrangement that the Pacific Northwest National Laboratory administers and each year a number of very bright kids coming in a Masters level predominantly come and have a week at the laboratory and then they go to work NNSA in different jobs, either in Washington or in Moscow or Beijing, and they have a tremendous exposure and it provides a wonderful filtering process for the government and so I have been extremely impressed with the quality of the caliber of people that that particular agency is able to attract. So the IAEA could do that on a world basis.

Now we're facing a situation of where we go from here. We're now at 2007, the Director General's term expires at the end of 2009, President Putin leaves I believe next year, President Bush leave is January of 2009, so there are changes that will come about. The nuclear renaissance I think – as I indicated there are some 200 plants being considered in addition to the 20 that are under construction so a lot of things are going to happen. Greenhouse effect has made nuclear a less partisan issue that advocates for environmental protection are now embracing nuclear – at least in many places not across the globe. So in the future we see expansion of that and stress again on the market. There's always the questions of the political process coming up to the NPT Review Conference in 2010, whether there will be progress made on the points that had been agreed to in the past that might now reach resurgence. So I think what we'll do now is to have a final round and final statements and anything you wish to address and be a little bit speculative on where you see the world going, your concerns particularly for IAEA safeguards in the future.

Casterton: If we're looking to future challenges I think it is going to be and it continues to be a very dynamic period for safeguards – for safeguards implementation. I think that there are many elements to this problem or this scenario. We've already alluded to some of it. I think it's fairly evident now in the last perhaps two to three years, the political environment in which we are trying to get things done in the safeguards area has changed dramatically. If you remember I spoke earlier about the meeting of technical capability and political imperative, political willingness, leading to what I would say was a fairly unprecedented period in the 90s to get things done. To improve the system that was in place at that time and to create a good situation for the future. I think we still have that to try and cultivate. The political environment has changed – for instance in the Board of Governors – than it was in the 90s. I think that efforts to try to look to the future and try to say, what will be the impact on safeguards. Will we need more safeguards, will we need different safeguards? Will we need more effective safeguards? Those kinds of discussions have to be informed and they will only benefit if there is the willingness at the political level to engage in those discussions to see where we want this system to go. Yes, we can think about what the world might look like in 5-10-15 years. But where do we want the safeguards system to go – it's not independent obviously than where the

world is going to go, but are we content with the safeguards system we have in place today? Do we think there are efforts still needed to strengthen safeguards to put the Agency in a better position to be able to provide the conclusions that we require or that we ask it to make? In that light I think that what we need to do is have an informed debate. I think that there is still some work that has to be done to get the message out on safeguards. I still believe that there are some inaccurate views about what the safeguards program of the IAEA is expected to do, can do, does do. And that leads I think the false expectations. It leads to criticisms that may be unjustified. And I think that in order to have any kind of basic discussion of the strengths and weaknesses of the safeguards system, now or in the future, to have a discussion of its failures or even its accomplishments, in the past or potential ones in the future, we have to have this informed debate. We have to make sure – I think Kaoru mentioned outreach – that we continue to emphasize the need for safeguards to be part of a very strong and very vibrant nuclear nonproliferation regime. One element of that, and a very minor one, is to ensure that there is accurate, readable, and understandable reporting on safeguards implementation. We have for instance a Safeguards Implementation Report that the Director General puts before the Board of Governors every June. It is telling the Board what verification measures the Agency has undertaken during the course of the year, what its conclusions are, what's the basis for those conclusions. This kind of thing has to be presented to a wider audience. In efforts to try and ensure that there is a sound comprehension of what the Agency does on our behalf.

The next issue of course is are we giving it the right level of resources to do what we want it to do. So I think what we are trying to do here is to make sure the debate – what ever happens in the future – is an informed one.

There are also issues on the implementation side. We spoke of the movement from a quantitative – of a primarily quantitative facility-level – to a more qualitative approach looking at State-level factors, safeguards culture issues, differentiation issues that others have mentioned as well. Those are all challenges that we have to deal with. The environment is going to change. You mentioned several elements of the environment that will change, whether it's leadership capacities that will change, whether it's new roles that will be thrust upon the Agency as a result of political changes. The Fissile Material Cutoff Treaty, should that happen – if does happen will there be a role for the Agency and, if there is a role for the Agency, what is that role in verification. How will it undertake that role? How will we define that role? So I think that there are many challenges ahead. I am encouraged because I think that the safeguards system through its practitioners - the IAEA, through its supporters and Member States, have demonstrated that they can be flexible, have demonstrated that they can address problems, have demonstrated that they can take the action necessary to ensure that nuclear energy is used for peaceful purposes. I think all we have to do is keep that in mind. It's not easy but we have to harness that kind of energy again and whatever challenges are confronting us in the future, including challenges of compliance, we have to keep in mind that we have to address these things and we need to address these things as a community – as an international community. My final word I think would be that hopefully mechanisms such as this exchange, this forum today, and I know the other work that you've done in

this series, will help to demonstrate to those who listen to what we have to say, that this is a very dynamic environment. It's a very rewarding area to work in. Others have already said that they've worked in it for several years – I too have worked in it for several years – I don't regret anything. One of the things I enjoy about is that you never know what's going to be on your plate on any given day. It's not good for planning but it's good for knowing that you're making a contribution in an area that is important. And not only that. The people that make the contributions they don't just come from a nuclear science field, they don't just come from the political science field, they don't just come from economics. There's a role in there for everybody and as we become more and more interrelated and interdependent, these opportunities have to become more and more available and advertised and hopefully these panels can try to make it more attractive. And then the final comment I would make – I do think I said the previous one was final – and that is, to a large extent, I think the future's going to see some new paradigms. I think we have talked about the nuclear nonproliferation regime that has developed over many decades now. We have the safeguards component of it, we have the export controls component of it, we have national policies. I think new paradigms might have to be developed in order to ensure that we can continue to work together. It's not what can safeguards do for export controls, it's not what export control and do for safeguards. What can all of that do for security? I think as Roger mentioned and as Jim [Tape] mentioned. we have to break down the paradigms to ensure that we develop the essential synergies – maybe we call it something else, I don't know. But we have to tap the competencies and capabilities in all of these areas because our job is to be one step ahead of the individuals, the States, or whomever, that want to work outside the system to challenge us to use nuclear energy for purposes other than peaceful purposes. And I think that we do need to be uniform in our approach to thwart their endeavors.

Tillwick: As Jim has indicated I think the environment is changing very fast and there was a presentation given by Laura Rockwood where she's given the legal change and the problems and challenges facing the Agency and how that has basically escalated and accelerated in the last number of years. When we talk about the acceleration it basically means that we have to look at scenario planning, look strategically ahead at how the Agency will address this. There are various things which the Agency did not experience in the last few years. The renaissance coming up. There wasn't a notion for example of sub-national proliferation networks. This wasn't on the horizon 3 or 4 years ago. All of sudden it's there. How do you deal with this? You've got to deal with this effectively because it's no longer on the State level – it's on the sub-state level that it's going through. This means basically that there's got to be far more and far closer cooperation with SSACs. And I think the expertise level will have to increase as well, looking at physical security. There are various other fields that are going to have to integrate with safeguards more so than in the past because safeguards on its own needs a few other basic pillars to secure the nonproliferation regime going forward.

If we look at the renaissance coming up, various issues have been mentioned in terms of the renaissance. One point I would like to bring up with the renaissance – and this reminds me of many of the World Trade Organization talks. When we look at these talks in terms of developing countries and developed countries you find that the developing

countries would like to have a part of the high technology pie as well. To basically centralize (i.e. the nuclear fuel cycle through GNEP) that into a single unit means that it has to be addressed on the political level. For safeguards going forward this will also be a big challenge.

In terms of the way looking ahead, if we look backwards 50 years - and this is what the Agency has been celebrating -50 years of the Agency this year – how did it start and what has been achieved in the last 50 years. If we are now going to look forward 50 years, what it will achieve. Probably, and I think Jim [Tape] has alluded to that, it is a very fascinating period we are living in going through SAGSI, it will be even more so. And with those words I'd like to pass it over to Roger. Thank you very much.

Howsley: I think it comes back to us being able to say that our industry is safe, secure and safeguarded. If we can't say those things, we are in trouble. And we saw after Chernobyl the impact that had on the nuclear programs from a safety point of view. Thankfully we haven't had a serious security incident and if we did that would also set back the industry. And there's been this niggling problem with – I'd say niggling problem's rather an understatement – of proliferation on the edge of the industry and I think we've really got to get a grip of all those things. I've already said that I think that the Agency's budget needs increasing but I think along with that comes, or should come, an increase in what I'd call private sector disciplines in the way the Agency behaves, and also in how the industry behaves - because I think the industry's still too dominated by State-owned industries. It needs to move forward. I think when it does some of the problems of things like excess inventories of materials and materials in poor condition which are heterogeneous and stored in drums of whatever, all of which give the Agency problems in terms of verification. Generally speaking the amounts of those sorts of materials in a well-run organization decrease because they cost the business. So as you get a more commercial approach to the industry, which I've said I think will come about through the emergence of a small number of multinational companies, I think that will facilitate safeguards no end. And the only other comment I'd make is that when I started in safeguards the explanation given for why nuclear weapons states had to have safeguards on some of their civil facilities was because of this concept of equal misery. And I think it's about time we replaced that by talking about equal leadership because I think you do need the leadership to make sure that the industry can succeed in the future.

Naito: As for new challenges I'd like to touch upon three points. One is the NPT regime. Another is the Board of Governors meeting in the IAEA. And the third, verification activities by the Agency.

As for the NPT regime, in the wake of DPRK doing the nuclear test and also the unsolved issue of Iranian nuclear program and also the aftermath of the 2005 NPT Review Conference, some people say the NPT regime has collapsed. But on the other hand this is how you see a glass with half quantity of water in – is it half empty or half full – that's the notion. The year 2010 Review Conference started with the first Preparatory Meeting and thanks to the excellent Chairmanship of Ambassador Amano (sp) I think we achieved a good success with the Preparatory Meeting. And so we had a good start. And so we

look forward to the year 2010 Review Conference that we will come up some concrete results. And everybody in the NPT should do their best to come up to this result.

Second, the Board of Governor's meeting. Somebody already touched upon the need for an increase in the safeguards budget. But in the past there is a parity issue – that is you increase some money in safeguards you also have to raise the same money in Technical Cooperation. This parity should be dis-linked and we have to talk with the countries about how safeguards is important and also maintain the same level of technical assistance.

The third area is verification activities by the Agency. As Jim [Casterton] said, safeguards is only one cog of a big wheel. So we have to have other means of nonproliferation. For instance, we have export control as Jim mentioned, Proliferation Security Initiative, PSI, Global Threat Reduction Initiative, Nuclear Terrorism Convention, the UN Security Council Resolution 1540 and etc. And also the Physical Protection Convention we have now a revised draft to be ratified. So we need lots of effort in other areas also and related to the verification activities by the Agency FMCT, the Fissile Material Cutoff Convention, should be also materialized. And also entry into force of the CTBT. And we will have to work together and the Agency may have a viable role in verification activities in the FMCT so we have to further exert our efforts in these areas.

Tape: Well there's not too much to add at this point coming at the end of the conversation, but I would just like to reemphasize a point made by a number of my colleagues that the safeguards system lives in a much broader context of nonproliferation. If you think about the incentives or disincentives that the leadership of a country might consider in taking a decision to proliferate, the effectiveness of the safeguards system may be a part of that, but I suspect that it's rather far down the list. Much more important are security assurances and the local security environment and so on. But where I think safeguards comes back to play a significant role, and an issue where I'd like to see the Agency reexamine how it operates is in dealing with the cases or suspected cases of noncompliance. For one thing, I would like to see the Agency return to a much more technical role in these areas. I think one of things that has put the Agency safeguards system at risk has been the distortions that have occurred in thinking about the safeguards system – Member State thinking about the safeguards system - that have resulted from the last few years' debate in the Board over the program in Iran. I think that many people are now thinking about safeguards only in this special case rather than in the broader case and it has led to quite a bit of political polarization in the Board, which is contrary to the productive future of safeguards. And in my mind the way to move back from this politicized atmosphere is to return more to the notion that this is a technical secretariat performing a technical job on behalf of the Member States. I think that would make an extremely important contribution as we go forward. As regards other things in the future I would personally hope that we do progress forward in other activities that relate more to arms control and to nonproliferation or that cross both ways – things like CTBT and an FMCT. And I feel rather strongly in the case of FMCT that there's every reason to think that the IAEA Secretariat and the Department of Safeguards in particular should be

asked to carry out whatever verification provisions might come out of an FMCT. I'm optimistic about the future; I think there's a lot to be done and a lot of important challenges in front of us. And I hope to be able to continue to do this for some time.

Hooper: I think we're winding down. I would like to just take a moment to communicate my admiration and respect. This has really been a pleasure and an honor to be involved in this. I thank you all very much.

Shea: I would strongly second that – it's a rare privilege. I would also like to come back to the point as mentioned in the beginning that the 5 people that we have the privilege to interview today are here together attending an INMM meeting and so it was a convenient opportunity. All members of SAGSI were invited. Had more been able to participate then the table would have been longer but I would repeat and reinforce that none of them speak as delegates of their countries or is this in any way related to any official function of SAGSI. And with that, I would say thank you again, thank you very much and safe travels home.