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Sophie MOURLON, ASN France - Good morning, ladies and gentlemen and welcome to Dijon. Nous sommes heureux de vous accueillir pour ce premier symposium NuPEER consacré au contrôle et à l'expertise en matière d'équipements sous pression nucléaires, organisé par l'Autorité de sûreté nucléaire française (ASN). Je m'appelle Sophie Mourlon, je suis le chef du BCCN, le Bureau de Contrôle des Chaudières Nucléaires. Cette sous-direction de l'ASN est en charge du contrôle des équipements sous pression nucléaires. J'occupe les fonctions de chef du BCCN depuis peu puisque David Emond, que certains d'entre vous connaissent, a été appelé au cabinet de la ministre du commerce extérieur la semaine dernière. Le changement de gouvernement en France lui a ouvert cette opportunité intéressante qui a nécessité une prise de décision très rapide. Je l'ai donc remplacé à la tête du BCCN.

L'ASN, et plus particulièrement le BCCN, ont voulu que ce symposium soit l'occasion, pour les équipes techniques en charge des équipements sous pression nucléaires au sein des autorités de sûreté et leurs appuis techniques, de se rencontrer et de partager leurs expériences. Cet objectif est déjà à moitié atteint : nous sommes aujourd'hui plus d'une centaine venus d'Allemagne, de Belgique, du Canada, des Etats-Unis, de Finlande, de France, de Norvège, de République Tchèque, du Royaume-Uni, de Slovénie, de Suède, de Suisse. Des représentants de l'AIEA, l'Agence Internationale de l'Energie Atomique à Vienne, de l'Agence pour l'Energie Nucléaire à l'OCDE et du Joint Research Center, JRC aux Etats-Unis sont également parmi nous. Ce symposium offre donc de formidables perspectives d'échanges techniques.

Pour cette première édition de NuPEER, nous vous proposons de réfléchir ensemble aux problématiques liées au vieillissement des équipements sous pression nucléaires. Pourquoi le vieillissement ? En France comme dans de nombreux pays, les centrales les plus anciennes encore en exploitation auront bientôt 30 ans.
Elles subissent de nombreux phénomènes de vieillissement qui posent la question de leur durée de vie pour une exploitation sûre. L'ASN, comme ses homologues étrangers, doit veiller à ce que les exploitants des centrales effectuent les démarches nécessaires pour maintenir et même améliorer la sûreté des réacteurs aussi longtemps qu'ils sont en exploitation. Ce contrôle doit s'effectuer tant sur le plan réglementaire et humain que sur le plan technique, avec rigueur et compétence.

L'ASN s'appuie sur les compétences techniques de son expert, l'IRSN, chaque fois que c'est nécessaire. Mais au-delà, l'ASN doit se tenir informée du retour d'expérience international. Elle considère également qu'il est important d'échanger sur les pratiques de sûreté. En effet, les échanges sur les informations techniques et les pratiques réglementaires sont susceptibles de nous aider à anticiper les dégradations liées aux phénomènes de vieillissement. Le BCCN, qui assure, au sein de l'ASN, le contrôle de la fabrication et du suivi en exploitation des équipements sous pression nucléaires, a maintenant plus de trente ans de pratique en la matière. Les nombreux dossiers qu'il a traités lui ont appris que la nature et la physique sont souvent plus inventives que les ingénieurs eux-mêmes, quelle que soit la compétence de ces derniers. Nous vous proposons donc de faire progresser nos connaissances, mais aussi d'initier des contacts et des échanges durables en laissant une large place aux débats au cours de ce symposium, que ce soit en plénière, en ateliers ou en table ronde. Soyons inventifs, pertinents et impertinents.

Avant d'entamer les débats proprement dits, nous invitons M. William Borchardt, directeur adjoint de l'Office of Nuclear Reactor Regulation, à la NRC américaine, à nous donner quelques mots d'introduction.

R. William BORCHARDT, NRC USA - Thank you very much. It is my pleasure to participate in the opening of this symposium on ageing issues in nuclear power plants. It is indeed appropriate to be holding this symposium on ageing issues.

There are over 430 operating power reactors throughout the world. While the designs may vary within and across borders, the fact is that there is much in common in the design, materials, fabrication methods and operating environments. It only follows that we, as regulators, researchers and operators, gathering in a forum such as this, have a special opportunity to learn from each others' experience in dealing with ageing issues. As we exchange information, expertise, operating experience and ongoing research among the international community, we recognise and respond to emerging technical issues and promote best practices. For example, implementing robust operating experience programmes provide an excellent means to highlight past and present corrective actions, including root cause determinations, and identify ways to prevent recurrence.

Why is ageing management or control of materials degradation such an important topic? From my perspective, there are three primary reasons. First, ageing management is an essential part of our overall mission to maintain the safety of the currently operating reactors. We need to ensure that every plant is operated safely all the time. Second, adequate and proactive ageing management can help to prevent future problems during the current operating cycle. This will have the additional benefit of saving operation costs in the long run. Third, it is an absolute pre-requisite for future reactor construction. We must demonstrate that we can adequately manage ageing issues of the current fleet of reactors since new reactors will also face the same ageing issues in the future. The public will not support new construction if the current fleet of reactors has a serious safety problem.

We are all familiar with the many essential practices of good ageing management as they are applicable to both active and passive systems, structures and components. They include routine surveillance, monitoring and trending activities, corrective actions, inspections and testing. Each of these activities by itself, or a combination of them, can help with the detection of ageing. Thus we may introduce appropriate preventative and corrective actions to address the associated problems. These practices of good ageing management are absolutely critical in the identification of potential or existing ageing issues.

The integrity of the reactor coolant pressure boundary systems of a nuclear plant is one of the most basic and essential aspects of reactor safety. Failure of this boundary would result in a loss of coolant accident, one of the most challenging accidents within the design basis. Degradation of the pressure boundary has proven to be one of the most challenging issues confronting operators and regulators since plants began to operate. In view of the fact that licences to operate nuclear plants are being, or will be, extended for many additional years of operation and that age-related degradation will continue to be an issue, this symposium is of particular interest.

The identification and management of ageing degradation must be proactive and integrated into our daily work. Most of you are familiar with the serious corrosion damage to the reactor pressure vessel at the Davis-Besse nuclear power station in the United States. There is an important ageing management lesson from this incident: ageing issues require our constant vigilance. Material wastage of components as a result of boric acid corrosion caused by the primary system leaks had been reported by the industry for more than 30 years. Alloy 600 nozzle leakage has been known for more than fifteen years. Yet, despite this knowledge, the operator of this plant did not prevent the severe corrosion of Davis-Besse reactor vessel head. Long-standing and recurring primary coolant leaks were not fixed. In other words, these known material degradation issues were not properly addressed or corrected at Davis-Besse.

Davis-Besse had previously been considered one of our better plants in the United States. Because operation had proceeded so smoothly in the past, plant staff did not bring to the job the constant vigilance that nuclear technology requires. Several warning signs were ignored, including the clogging of containment air coolers and of the filters on containment radiation monitors, all of which may be considered part of the ageing phenomena. In addition, there was evidence that pressures for production were given higher priority than concerns for safety. As a result of this event, the plant outage continued for more than one year, increasing public concerns about the plant, including demands for permanent shutdown, and hundreds of millions of dollars were spent for repairs and upgrades. Davis-Besse's reactor head corrosion was considered a direct result of a degraded safety culture. At the same time, it has also revealed that the physical contributors to the incident were

various ageing degradations of plant systems and components. Though we believe that we have a comprehensive programme for nuclear safety, the Davis-Besse event reinforces the need to remain watchful.

This symposium is an excellent forum to encourage such vigilance and to learn from the experience of others. This meeting is an opportunity to generate ideas and to share international experience. It will also inform and enhance our collective efforts to improve worldwide safety. We all benefit because an accident anywhere in the world will affect each of us. We can enhance nuclear safety worldwide through national measures and international cooperation. As reflected by the programme of this symposium, there is a wide spectrum of ageing issues which are of interest. Ageing management and safety of nuclear plants are primarily the responsibility of operators. Regulatory oversight practices vary from country to country but we have much to gain by understanding each other's approaches, lessons learned, and future plans. Research plays an integral role in the process of ensuring safety by contributing in areas such as advancing the understanding of degradation mechanisms and the progress of these mechanisms and improving the tools to identify ageing.

Age-related degradation is a day-to-day issue for operating plants. Let me briefly discuss an example that we consider to be of high significance, which is the primary water stress corrosion cracking and consequential boric acid corrosion. Nickel-based alloys have been used extensively in reactor coolant systems of light water reactors throughout the world. As I am sure you recognise, the regulatory framework in the United States relies in part on inspections prescribed by the American Society of Mechanical Engineers. The ASME code was not written with the foreknowledge of PWSCC and does not require frequent enough inspections to address this issue. Similarly, the ASME code does not currently require the types of inspections that lead to promptly identifying leakage that could cause boric acid corrosion. This situation necessitates that the gap be filled by proactive and timely steps on the part of the industry to develop and implement inspection guidelines. Regulators have the responsibility to the public to ensure that such steps are taken. The NRC has issued a number of bulletins and an order in recent years on the subject of PWSCC and boric acid corrosion. The NRC has continuing concerns regarding PWSCC and nickel-based alloys.

On the topic of licence renewal, it is important to recognise that there are 103, soon to be 104, operating reactors – with the restart of Browns Ferry 1 in the near future – licensed to operate in the United States. The size of this fleet necessitated that the NRC and the US industry agreed on a strategy for licence renewal that was sufficient and that minimised regulatory uncertainty. The initial licences for power reactors in the United States were issued for 40-year terms. The NRC developed a licence renewal process that established the technical and administrative guidelines for renewal of plants for an additional 20 years beyond the original 40-year term. Licensees who apply to extend their licences must demonstrate that their ageing management programmes are in place to manage those ageing effects applicable to the passive, long-lived plant components and structures. For degradation mechanisms such as fatigue and neutron embrittlement, the safety reviews must verify that the design and analysis conclusions, based on the current operating term, have been evaluated and are valid for the 20-year extended period of operation. As of this month, the NRC has reviewed the operating licences for 32 units and approved each of those applications. The NRC has developed a number of internationally available licence renewal guidance documents to describe the inter-related aspects of preparing and reviewing licence renewal applications. The industry has provided extensive comments and input into the development of these documents. An example is the Generic Aging Lessons Learned, or GALL Report, which catalogues plant components and structures, lists the materials, environments, ageing effects and mechanisms, and documents how existing commonly-used plant programmes can be used to enhance or mitigate these ageing effects.

Let me summarise by noting that global energy needs continue to grow. While nuclear power generation will remain in the mix of energy production, extending the operating life of existing nuclear power stations is, for some utilities, an economically feasible way to meet future energy demand. This increases the importance of managing ageing issues. The responsibility of plant operators, regulators and researchers is to work in their distinctive roles to ensure that ageing issues are effectively and safely managed. I join you in looking forward to the presentations over the next two days and participating in the workshop discussions and debates. Thank you for your participation in this symposium and my best wishes to you for a successful and productive meeting.