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Bulletin de la Section Française de l'ANS

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Sommaire :

Editorial du Président

Chers amis,

Comme tous les ans, nous allons élire le futur Président de l'American Nuclear Society et cette année les deux candidats, Andy Klein et Jim Tulenko, font l'un et l'autre partie du corps enseignant, puisque Andy est professeur à l'Université d'Oregon et Jim à l'Université de Floride.
Avoir un professeur à la tête de la plus grande société savante nucléaire du monde souligne l'engagement, aux Etats-Unis, de représentants de la communauté scientifique en faveur de l'énergie nucléaire.

Cet événement n'est pas un fait isolé. Pour la première fois depuis vingt ans un nouveau Département d'ingénierie nucléaire est créé dans une université américaine, celle de Caroline du Sud, et vient compléter la quarantaine d'institutions qui dispense déjà des cours dans ce domaine, avec des effectifs à nouveau en hausse après une période de forte décroissance.

Ce retour des étudiants vers le nucléaire traduit un regain d'intérêt pour un secteur qui embauche et où les salaires sont attrayants. La Caroline du sud, par exemple, offre de nombreux débouchés avec sept réacteurs en exploitation, l'usine de fabrication de combustible de Westinghouse et le laboratoire national de Savannah River. Il résulte aussi d'une action volontariste du DOE qui par le biais de diverses modalités de financement (bourses de recherche, projets NERI et soutien aux infrastructures universitaires) encourage ce mouvement.

L'enseignement des sciences et techniques nucléaires a toujours fait l'objet d'échanges suivis entre la France et les Etats-Unis. Dans ce numéro un article est consacré à l'INSTN et en particulier aux relations qu'entretient cet organisme avec plusieurs Universités américaines.

La SFANS de son côté organise chaque année des échanges de stagiaires entre les deux pays. Côté français, la procédure de sélection est engagée et les candidats ont été invités à un entretien d'évaluation fin mars (voir rubrique :" Nouvelles de la SFANS").
La SFANS, par ailleurs, a reçu l'été dernier, et pour la cinquième fois depuis 1996, une délégation de professeurs américains, avec une visite d'installations consacrées à l'aval du cycle et à la gestion du Plutonium.

Le développement du nucléaire va nécessiter l'émergence de forces nouvelles, la SFANS, dans la mesure de ses moyens, doit s'efforcer d'y contribuer.

A. Vallée

8 "Status of Nuclear Power in the United States" par R. Meserve

R. Meserve a quitté fin mars, quinze mois avant l'échéance prévue, son mandat de responsable de la NRC pour devenir Président de la Carnegie Institution à Washington. Il a été remplacé, sur nomination du Président Bush, par Nils Diaz, commissaire à la NRC depuis 1996.
Avant de quitter ses fonctions, R. Meserve a effectué une tournée en Asie et à l'occasion de la "13th Pacific Basin Nuclear Conference" a dressé un bilan de la situation du nucléaire aux Etats-Unis.
En conclusion, il rappelle l'engagement de la NRC de maintenir une large participation de cet organisme dans des programmes de coopération internationale.

Current Status and Recent History of the U.S. Nuclear Power Program

A DECADE OF STEADY IMPROVEMENT

With **103 operating reactors** providing a total of almost 100,000 megawatts, the United States nuclear fleet currently accounts for about one-sixth of our electric generating capacity. The nuclear plants, operating in 2001 at a record capacity factor of approximately 90 percent, generated almost 770 billion kilowatt hours, representing more than **20 percent of the nation's total output of electric energy**. Preliminary data for 2001 show that the average production cost of nuclear electricity was around **1.8 cents per kilowatt-hour**, lower than that for coal or natural gas. And it is estimated that the U.S. avoids over **160 million tons of carbon emissions** by virtue of displacing fossil-fired generation with nuclear plants.

These statistics stand in stark contrast to the mediocre performance of U.S. nuclear utilities at the beginning of the 1990s, and represent the result of more than a decade of steady – one might even say remarkable – improvement in both plant economic performance and plant safety performance. These trends are illustrated clearly if we look at historic performance data. In 1990, with 111 nuclear units in operation, the industry's capacity factor stood at about 65 percent as compared to nearly 90% in 2000 and 2001. Total generation in 1990 was just over 550 billion kilowatt-hours, while today 40 percent more energy are generated with eight fewer plants. Industry economic performance reflects these improvements, with the production cost of nuclear electricity falling from close to 3 cents per kilowatt-hour to less than 2 cents.

What accounts for these impressive improvements? I believe that they reflect the fact that around 1990, both the industry and the NRC turned their attention to improving plant operations. As it happens, the industry's safety performance in 1990 was as unimpressive as was its economic performance at that time. More than 50 events were

classified as “significant,” or almost one for every two units, and each unit, on average, experienced one safety system actuation during the year. In 2000, however, the number of significant events had decreased by more than an order of magnitude, and the average number of safety system actuations per year decreased from one per unit to about one for every three units. Other safety performance data show similar trends.

It is little wonder that when industry “pundits” looked at plant economic performance in the early 1990s, they predicted that, with the beginning of the deregulation of retail pricing of electricity, nuclear plants would be unable to compete economically, and many would be shut down prematurely. Today’s situation tells a much different story, however, and **clearly demonstrates the correlation between plant safety performance and plant economic performance**. A plant that operates safely also operates reliably, and is thus able to contribute to the financial bottom line.

The improvements in nuclear plant safety and economics do not mean, however, that either the NRC or the industry can become complacent about operations.

The recent, well-publicized experience with severe corrosion of the reactor vessel head at the Davis Besse plant demonstrates clearly that we are still learning about the things that can go wrong at a nuclear plant, reinforcing the need for continued vigilance both in licensee operations and maintenance programs and in NRC oversight.

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EXTENDING THE CAPABILITIES OF EXISTING PLANTS

Currently operating plants are the subject of two major initiatives: power uprates and license renewal. **Power uprates** are not new; the NRC has previously approved more than 80 applications to increase reactor power, resulting in an increase in generating capacity of almost 4000 megawatts electric. However, licensees may now increase power by taking advantage of improved power measurement techniques, and better analytical methods have permitted licensees to demonstrate that reactor power can be increased, in some cases substantially, without unacceptable reduction in safety margins. We have been informed by our licensees that they expect to submit at least 51 applications for power uprates over the next five years, resulting in the addition of almost 2000 megawatts of electrical generating capacity.

License renewal, on the other hand, is a relatively recent initiative undertaken by the NRC and our licensees. The statute governing the NRC permits the issuance of power reactor operating licenses for periods of not more than 40 years. But that same law permits us to renew those licenses at the end of that initial 40-year period. The first application seeking an **additional 20 years of operation** was submitted to the NRC in 1998, and was approved in 2000. We have continued to receive applications at a steady pace, and to date, five plants, comprising 10 units, have had 20-year license renewals approved. Ten applications (covering another 16 units) are currently under review, while approximately 16 applications (covering 29 units) are expected to be submitted over the next three years. All told, approximately half of the operating nuclear units in the U.S. are currently involved at some stage in the license renewal process, and we ultimately expect that **almost all operating plants will eventually apply for license renewal**. If the licensees are successful in obtaining 20-year extensions, the net effect of the license renewal program will be to extend the period during which the current generation of plants contributes significantly to the U.S. electrical supply well into the early 21st century.

Outlook for the Future

DESIGN CERTIFICATION / EARLY SITE PERMIT / COMBINED LICENSES

If nuclear power is to continue to be a significant factor in electric power generation in the U.S. beyond the first third of this century, new nuclear plants will need to be constructed. In an effort to streamline the licensing process for new nuclear power plants, the NRC has put in place rules for certifying the designs of standardized nuclear plants, for "banking" reactor sites for future use through early site permits, and for issuing combined construction permits and operating licenses.

During the 1990s, the NRC certified three advanced plant designs under this new process: General Electric's Advanced Boiling Water Reactor, or ABWR; Combustion Engineering's System 80+; and Westinghouse's AP600.

In the last two years, the vastly improved performance of the current nuclear fleet has created substantial interest in the possible construction of new nuclear plants. The NRC has restructured its reactor regulation organization to prepare for more design certification reviews and for possible combined license applications. We are currently reviewing Westinghouse's application for certification of the **AP1000** design, an upgraded version of the AP600. We have also been informed of several vendors' intentions to submit certification applications for five designs within the next several years — GE's natural circulation **ESBWR**, Framatome ANP's **SWR-1000** boiling water reactor, AECL's **ACR-700** (an advanced CANDU concept), GA's **GT-MHR** (a modular, gas-cooled reactor), and Westinghouse's **IRIS**, a small integral PWR. And we are expecting to receive applications for early site permits from three electric generation companies – Dominion, Exelon, and Entergy – all of which will involve sites on which reactors are currently operating.

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Perspectives on International Cooperation

THE VALUE OF INTERNATIONAL COOPERATION IN NUCLEAR REGULATION.

In the regulatory arena, while the U.S. has the world's largest nuclear power program in terms of number of reactors, we recognize that we can benefit greatly from the experiences of other countries. Conversely, we hope that our colleagues outside the U.S. will be able to benefit from our experiences. Although the NRC sponsors a broad and comprehensive research program, the cost of building experimental facilities and running testing programs has become so great that it would be impractical for us to attempt to conduct such programs on our own. We therefore participate in **multilateral efforts**, for example through the International Atomic Energy Agency, the Nuclear Energy Agency of the OECD, and in bilateral exchanges and cooperative programs. We also welcome international assignees for temporary service on the NRC staff, and we send our staff members to other countries for similar purposes.
During my first trip to Asia in 2000, I expressed my personal commitment and that of the NRC to continuing our **broad participation in international cooperative programs**. That commitment is as strong today as it was then. It is essential that we continue to maintain a high standard of operational safety. A significant event at a nuclear power plant anywhere in the world will have an impact on all of us. No matter in which part of the nuclear industry we may work – regulatory, design, or plant operation – each of us has a stake in ensuring that safety is the top priority in the performance of our jobs.

8 Libre Opinion:

"U.S. Realities, New Plants and the Future Nuclear Fuel Cycle" par A. David Rossin.

En écho à l'article de R. Meserve et dans le cadre d'une nouvelle rubrique, intitulée "Libre Opinion", nous avons demandé à D. Rossin de nous faire part de son sentiment sur l'état du nucléaire aux Etats-Unis.
D. Rossin a été "Assistant Secretary" pour l'énergie nucléaire au DOE en 1986 et 1987 et Président de l'ANS pour la période 1992-1993. Il est désormais consultant pour les problèmes de sûreté et de non-prolifération.

Ardent défenseur de l'énergie nucléaire, il dresse un tableau plutôt mitigé de la situation actuelle. Ses propos, volontiers provocateurs, traduisent sa déception à l'égard du comportement passé de l'Administration américaine. Il dénonce en particulier les conséquences toujours perceptibles de la doctrine dite Carter sur la non-prolifération. Certes il prend acte des évolutions récentes de la politique américaine sur le retraitement du combustible et sur les réacteurs à spectres rapides, mais à ses yeux l'horizon Génération IV reste bien lointain!

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There is obviously a long-term need world-wide for more nuclear power. Currently it is stalled in the United. States. Other nations hesitate and watch to see what we will do. The only visible progress is some limited university research, plant license extensions after lengthy reviews, dry cask storage, and preparations for licensing Yucca Mountain. We need an order for construction to begin on a new nuclear power plant that could demonstrate the viability of the new standardized plant design one-step licensing process. In order for that to happen however, several critical financial barriers discussed below must be overcome.

Political support is needed to sustain large investments in long-term projects. In our participatory democracy, this means a level of commitment to goals that can withstand opportunistic attempts to stall or stop expensive construction, like nuclear power plants or fuel cycle facilities.

This means a positive, rather than negative, government position on nuclear power. Some feel that significant government funding will be essential for the first new nuclear order in more than two decades. Others believe that a financial structure can be achieved, but that depends on a level of confidence that a future administration will not pull the rug out!

Our snail-paced progress on Yucca Mountain has been a massive case study! The public became skeptical about our ability ever to dispose of high-level wastes safely and even to transport spent fuel across the country. But the decisive vote by the Senate in 2002 effectively put waste disposal on a positive path. The waste issue has dropped off the political screen. Most members of Congress have little appetite for any more nuclear waste debate.

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Barriers to New Plants and Closing the Fuel Cycle

The financial challenges that need to be surmounted for the first new plants are real. Public acceptance may be a matter of image, but it remains a significant hurdle.

The 2001 Energy Task Force under Vice-President Cheney is now remembered only for its secrecy and for listening to big corporations and not citizen groups. No one remembers what its report said! It did mention **the need for more nuclear power and to re-examine reprocessing**. That was one reason it became a target!

But the facts are:

◊ No reprocessing plant will be built in the United States any time soon.
◊ Neither reprocessing nor a closed fuel cycle in the United States are essential to the next set of nuclear plant orders.
◊ Licensing of a standard plant on a pre-approved site has yet to be demonstrated.
◊ Can capital be raised for a major, long-term energy project in the new, deregulated energy atmosphere, particularly if the investment is a nuclear power plant?

Larry Foulke, ANS President-elect, discusses these points in an excellent article in Nuclear News[(1)]. He examines in detail the role government may have to play to stimulate construction of the next nuclear plant.

Reprocessing and the Fuel Cycle

Fuel with long core life now powers plants all over the world. MOX recycle is a commercially proven technology, and plants in the United States could be adapted to use it. MOX costs more than low-enriched fuel now, but even in France experience is limited and costs remain uncertain. With few new power plants under construction, both uranium and uranium enrichment prices will stay low. However, the cost differences between fresh fuel and MOX are only a small part of the overall cost of power production.

The closed fuel cycle and breeder reactors remain vital to the long-term energy future for the Earth. We believed their need was critical three decades ago if nuclear power were to grow as planned. It did not, and arguably the American "indefinite deferral" of reprocessing in fear of proliferation as well as the abandonment of the breeder reactor program contributed to that slowdown.

Nuclear experts felt that putting spent fuel deep in the ground was morally wrong in a world that needs energy. Now there is an awful lot of spent fuel around. What American people want is assurance that highly radioactive used fuel can be buried at all! Hopefully, that Yucca Mountain vote has put us on a path to provide that assurance.

Licensing and the Money

Since electricity deregulation, utilities no longer have the assured stream of revenue that is needed to fund huge long-term investments. Many are barely credit-worthy at all anymore. This seems to be the key point when it comes to building any new nuclear facilities. Large amounts of capital are needed for long-term projects like nuclear power plants, and the financial returns come only after many years.

The success of NRC's standard design process has not yet been demonstrated; however there are some companies that are examining the possibilities for building a new plant based on one of the approved standard designs. Its fuel and operating costs would be below that of coal or gas. If it could be built on schedule, the carrying charges on its capital cost would still be significant, but it would be competitive as a part of the mix of generation supply. This would certainly be enhanced if security of supply, long-term economics and carbon dioxide emissions are taken into account.

A new nuclear plant might compete with gas at $5/MBTU. But why should it? Our deregulation fiasco has cost the nation the benefits of diversity of fuel supply, and of long-term contracts to insure reliability. We paid a small premium for this insurance against short-term price pressures, and it avoided the crises of 2000 – 2003.

So it may be necessary to put together a new type of financial structure to take regulatory and financial risks. Financial institutions are concerned that even projects recognized to be essential to our energy needs can be delayed and ultimately derailed by small groups who carry no responsibility for the nation's future.

Only when enough leaders feel that the case for nuclear power is strong enough will investors step up. The safety risks are, in reality, low. The financial risks for any single project are harder to predict. That issue may ultimately turn on whether or not people came **to realize the importance of reliability and diversity of fuel supply**.

Early experience with deregulation revealed that some people were willing to pay extra for "green" energy sources. **Diversity of fuel deserves a far greater premium**. Recognition of this could bring a new financial equation into the economics of deregulated energy.

Nonproliferation

The arguments that turned President Carter against a nuclear future are better understood today[2]. They have been shown to be inadequate to support his opposition to reprocessing. Some of his advisors argued that it was economics rather than nonproliferation that led them to support Carter's policy. However, they were looking only at the incremental cost differences between MOX and fresh fuel, not at the overall economics of power generation.

Carter said that stopping reprocessing would eliminate a major pathway to nuclear weapons. But there are other pathways.

History proves that no nation diverted plutonium from commercial reprocessing for nuclear weapons. Each nation is a story in itself, but Israel, India, Pakistan, South Africa, North Korea and Iraq (as well as several others that began some work) conducted its weapons work in secret. Some had no nuclear power at all, and some still have none today. Secret facilities are not influenced by commercial examples.

Carter believed that he could convince other nations to follow his lead. They did not. But the use of **commercial plutonium became identified with nuclear proliferation**, and this image has led to greater public fear and distrust of nuclear power.

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The U. S. DOE's Gen IV program, despite its limited funding, suggests that nuclear power needs to be a part of our energy future. A number of major universities have joined with corporations on Gen IV projects, which is important for the future of nuclear engineering programs and attracting new students. The new designs and concepts are beyond the time period of this report, but the important thing is that now they include fast reactors and fuel cycles that include reprocessing and separation of plutonium[3].

The time is approaching when democratic nations have to face the reality that we cannot meet the expectations of people without adequate electricity. We cannot meet the needs of a hydrogen economy or of charging electric vehicles with wind, solar and biomass. It sounds pretty crazy to charge batteries and separate hydrogen with electricity generated by burning natural gas. We've squeezed the economical steps for efficiency and conservation; the next ones will cost a lot more. The nations of the world talk about the challenge of Kyoto. And here we sit with a technology that works and works well, and with costs that are not out of the ball park.

(1) L.R. Foulke – The status and future of nuclear power in the United States- Nuclear News, Feb 2003
(2) Dr M. May, former Director of LLNL, provides a full discussion of the engineering and practical problems that face the weapons designers if they had to use high-burnup or "reactor-grade" plutonium in actual nuclear weapons systems. – Nuclear Weapons Supply and Demand – American Scientist, vol 82, November-December 1994.
(3) For an up-date, visit http://www.ne.doe.gov/reports/AFCI_CongRpt2003.pdf

8 "L'INSTN" (http:/www-instn.cea.fr)

L'Institut National des Sciences et Techniques Nucléaires, créé en 1956, est un établissement d'enseignement supérieur rattaché au Commissariat à l'Energie Atomique.
Cet organisme est implanté à Saclay depuis sa création, ainsi qu'à Cadarache depuis 1976. Il s'appuie sur l'important potentiel scientifique et technique des laboratoires du CEA et sur les compétences de leurs ingénieurs et chercheurs. Contribuent également aux sessions de formations, des représentants d'entreprises industrielles, comme le Groupe Areva ou EDF, ou des experts de l'Institut de Radioprotection et de Sûreté Nucléaire (IRSN).
L'INSTN délivre un enseignement de spécialisation en Génie Atomique qui dure une année, avec des cours répartis entre le 15 septembre et fin mars suivis d'un stage de six mois en entreprise ou dans un laboratoire de recherche. Ces stages se terminent par la rédaction d'un rapport et d'une soutenance devant un jury désigné par l'INSTN.

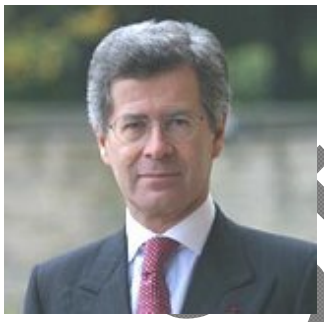
Des relations et des accords de recherche ont été établis avec des instituts d'enseignement et des laboratoires américains au nombre desquels : Massachusetts Institute of Technology, Argonne National Laboratory, Oakridge National Laboratory, Penn State University, Texas A&M.

Certains stages de fin d'études sont donc effectués dans ces établissements.

L'INSTN dispense également un enseignement à l'Ecole des Applications Militaires de l'Energie Atomique (EAMEA).

Par ailleurs, l'Institut se charge de l'organisation de séminaires internationaux à la demande de l'AIEA, de l'Union Européenne ou dans le cadre de l'Association pour le développement de l'enseignement nucléaire international (ADENI).

8 Un nouvel Ambassadeur de France à Washington



Depuis la fin du mois de décembre, Monsieur Jean David Levitte, nouvel ambassadeur de France à Washington, dirige l'action de la France aux Etats-Unis. Monsieur Levitte était précédemment ambassadeur, chef de la Représentation permanente de la France auprès de l'Organisation des Nations Unies (2000 - 2002). Diplomate de carrière, il était Conseiller et "sherpa" du Président Jacques Chirac de 1995 à 2000.

Monsieur Levitte est entré au Ministère des Affaires Etrangères en 1970 et a servi à Hong-Kong (1971) puis Pékin (1972-1974). A son retour à Paris, il est nommé à la Direction des affaires économiques du Ministère des Affaires Etrangères et, après une année à ce poste, il devient Chargé de mission au Secrétariat général de la Présidence de la République (1975-1981). En 1981, son premier séjour le voit Conseiller à la Mission permanente de la France auprès des Nations Unies à New York. Il revient à Paris en 1984 pour prendre les fonctions de Sous-Directeur de l'Afrique de l'Ouest, puis Directeur adjoint au Cabinet du Ministre des Affaires Etrangères. Il est ensuite nommé Ambassadeur, Représentant permanent de la France auprès des Nations Unies à Genève en 1988, et ce jusqu'en 1990. Il revient à Paris cette année là en tant que Directeur d'Asie et Océanie au ministère des Affaires Etrangères, puis Directeur général des relations culturelles, scientifiques et techniques (1993-1995).

Jean-David Levitte est né le 14 juin 1946 à Moissac, dans le Tarn et Garonne. Il est titulaire d'une licence en Droit et diplômé de l'Institut d'Etudes Politiques ainsi que de l'Ecole nationale des langues orientales.

8 Nouvelles de la SFANS

Ø **Jean-Louis Nigon distingué**

Jean-Louis Nigon, Adjoint au Directeur de la Recherche et du Développement de Cogema, a reçu la distinction de **Fellow** de l'ANS lors du Winter meeting de novembre dernier :

«**pour son important leadership dans le développement des réacteurs à eau légère, notamment en physique des réacteurs, sûreté nucléaire, combustible et conception des cœurs, pour son engagement personnel dans le développement de la coopération internationale en matière de R&D nucléaire, pour ses efforts, en tant que Président de la SFANS, pour intensifier la coopération entre l'ANS et la SFANS et pour son grand dévouement à l'enseignement et à la formation dans le domaine nucléaire.**»

Ø **France Brès-Tutino, future Présidente du Comité International de l'ANS**

Le President-élu de l'ANS Larry R. Foulke a sollicité notre collègue France Brès-Tutino, membre du bureau de la SFANS, pour qu'elle devienne, pendant la période de juin 2003 à juin 2004, Présidente de l'International Committee de l'ANS.

L'objet de cet International Committee est en particulier de faciliter les relations et les accords de coopération entre l'ANS et d'autres Sociétés Savantes au travers le monde.

Ø **Echange international d'étudiants**

Suite à l'appel à candidatures lancé par la SFANS auprès de plusieurs écoles d'ingénieurs, une quinzaine d'étudiants intéressés ont répondu, notamment des élèves de l'Ecole Nationale Supérieure des Mines de Paris, l'Ecole Nationale Supérieure d'Electricité et de Mécanique de Nancy, l'Institut National des Sciences Appliquées de Lyon, l'Ecole Polytechnique et l'Ecole Centrale.

Le jury s'est réuni le 20 mars sous la présidence d'Alain Vallée, et chacun des membres - Pascal Guihot d'EDF, Bernard Guesdon de Framatome ANP et Yves Vandenboomgaerde du CEA - s'est entretenu avec les huit candidats, sélectionnés sur dossier, afin d'évaluer leurs compétences et leur motivation. Il faut noter que ce type de stage peut en général entrer dans le cadre d'un stage de fin d'études.

Les dossiers retenus sont ensuite proposés aux trois laboratoires de recherche désireux d'accueillir des stagiaires français durant l'été dans le cadre de cet échange parrainé par l'ANS, le DOE et la SFANS, à savoir : Argonne, les universités de Purdue (Indiana) et de l'Etat de l'Oregon.

Réciproquement, les thèmes de stage proposés par le CEA et Framatome ANP sont communiqués aux étudiants américains de ces universités, intéressés par un stage de trois mois ou plus dans une équipe de recherche française dans le domaine nucléaire**.**

8 La conférence " Supercomputing in Nuclear Application" – SNA'2003

Cette conférence internationale dédiée aux applications nucléaires du calcul intensif aura lieu à Paris du 22 au 24 septembre 2003.

Elle est organisée par le CEA, la SFANS et l'OECD/NEA et sponsorisée par les grands organismes du nucléaire français (Areva avec Framatome ANP et la Cogéma, l'ANDRA, EDF) ainsi que par les Sociétés Savantes du domaine (ANS, AESJ, ENS, etc.).

Cette conférence est la cinquième du genre après le Japon en 1990, l'Allemagne en1993, les Etats-Unis en 1997 et à nouveau le Japon en 2000.

Plus de 200 participants y sont attendus et plus de 140 communications, en provenance de 25 pays différents, seront présentées.

Toutes les informations relatives à cette conférence sont disponibles sur le site http://SNA-2003.CEA.fr.