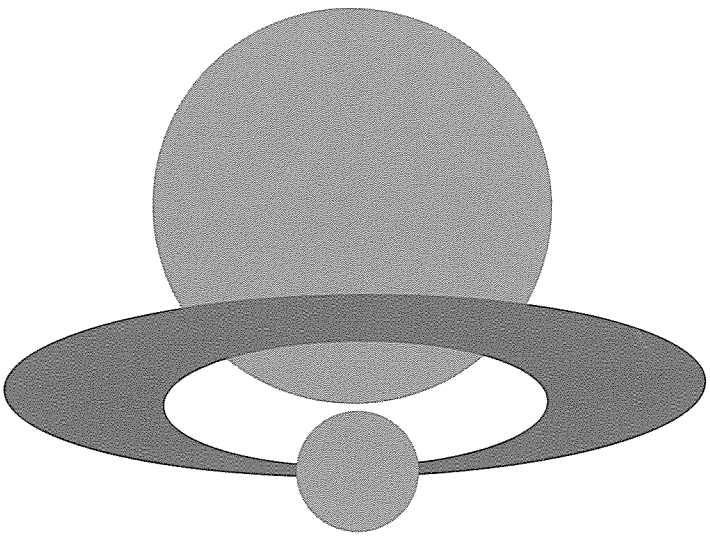
The 29th JAIF ANNUAL CONFERENCE

ABSTRACTS

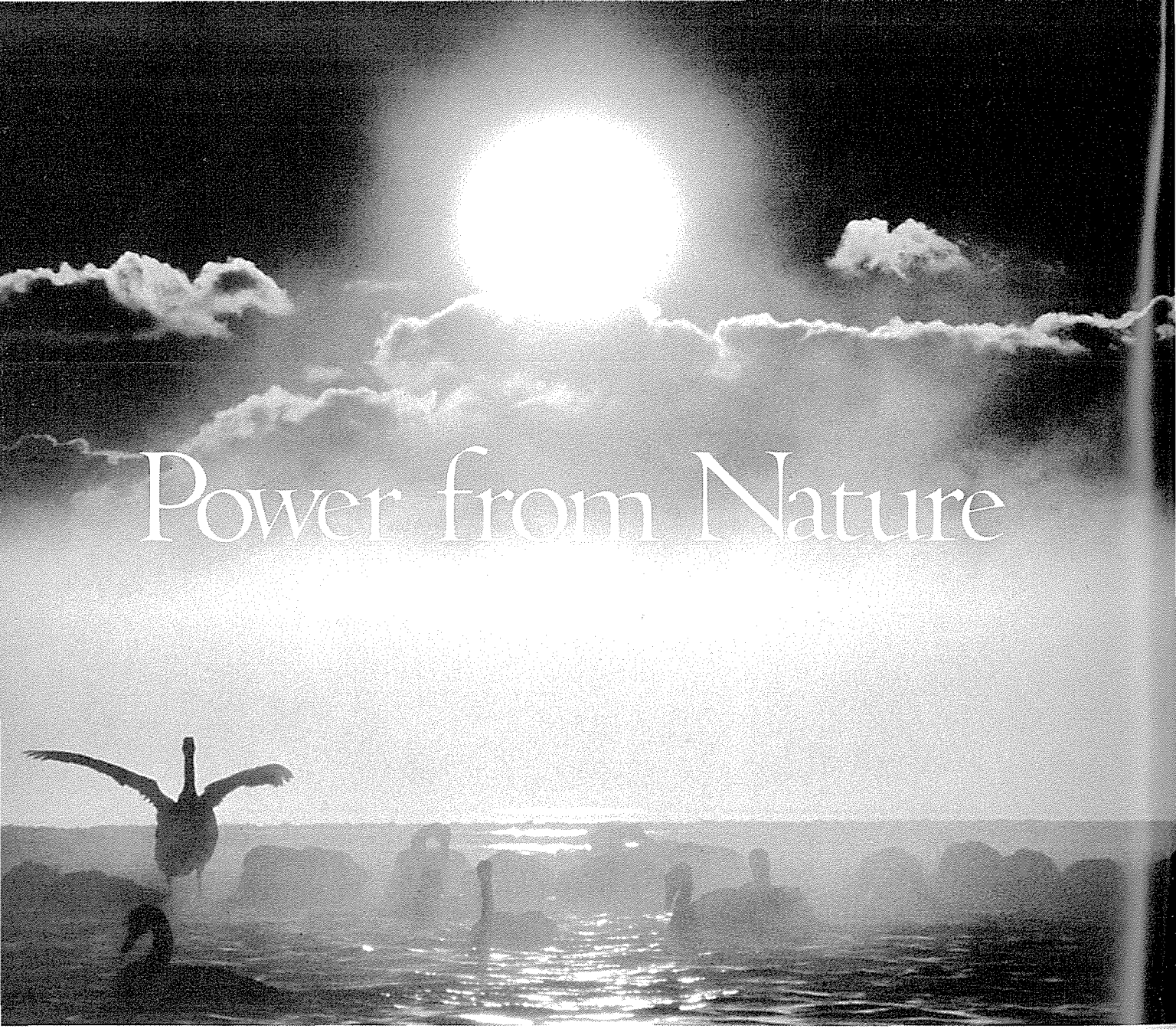


April 17–19, 1996

Nagoya Congress Center

Nagoya, Japan

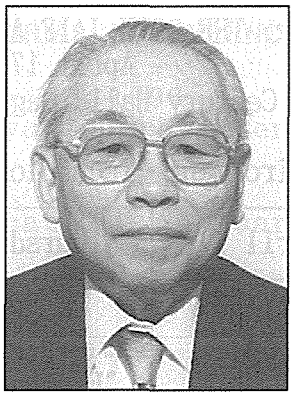
JAPAN ATOMIC INDUSTRIAL FORUM, INC.



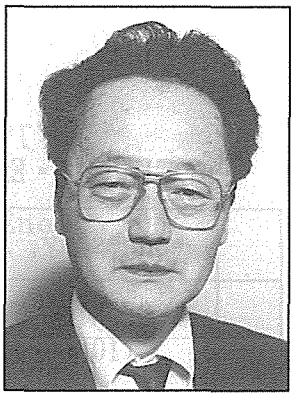
About 50 years ago mankind first generated nuclear power. It was an experiment. It worked. Commercial power generation began. And plants became increasingly complex.

Today the evolution is unceasing. But as our knowledge of nuclear energy increases, the trend is towards simpler systems that employ natural forces. Because, like the sun, nuclear energy occurs in nature. The way we are thinking at Hitachi, it's simply power from nature.

HITACHI



Takashi Mukaibo
Chairman, JAIF



Tsuneo Iida
Chairman
Program Committee

THE 29TH JAIF ANNUAL CONFERENCE

Basic Theme:
"Energy・Environment・Technology—What Can Nuclear Energy Do?"

The end of the Cold War has resulted in a great change of the international community, which characterizes necessary cooperation in constructing a new world order. As a positive movement, last May the NPT review and extension conference successfully concluded with the majority of support for its indefinite extension. However, the management of plutonium from dismantled nuclear warheads and the proliferation danger of nuclear weapons have still been posing significant challenges to the entire world.

Energy shortage is also a plausible obstacle to the world development as newly industrialized countries such as the Asian will sustain the current economic growth and energy demands thereby. Securing energy sources will remain one of the main questions to be resolved as each nation pursues its prosperity. In view of growing worldwide environmental concern, it is getting more significant to stress their environmental integrity.

The environmental preservation provides a main spur for developing nuclear energy especially in Asia where major energy source is coal. It is significant, however, to consider the negative aspects inherent to nuclear energy. The management of radioactive waste remains a great concern in lessening their environmental impact.

There is no energy source with no environmental load. Many factors influence each nation's energy policy, including natural resources, economies, political concerns, etc. Energy is one of the significant components for security of a nation, which poses a simultaneous impact on the global environment.

In view of those aspects, also focusing on the consequences of Chernobyl and the accident at prototype FBR "Monju," we will now hold the 29th JAIF Annual Conference. We encourage all of you to take part in lively discussions in the Conference.

THE 29TH JAIF ANNUAL CONFERENCE
April 17-19, 1996
Century Hall, Nagoya Congress Center

"Energy • Environment • Technology—What Can Nuclear Energy Do?

	Wednesday, April 17	Thursday, April 18	Friday, April 19
AM	OPENING SESSION (10:00～12:00) [Lectures]	SESSION 2 (9:00～12:00) "Expanding Nuclear Power Programs in Asia" [Panel discussion]	SESSION 4 (9:00～12:00) "High-level Waste Management--Promoting R&D and Consensus Building" [Lectures]
PM		LUNCHEON (12:15～14:15) at Shirotori Hall --- FILMS (13:00～14:00)	
	OPENING SESSION (13:30～15:00) [Lectures] ——Coffee Break——	SESSION 3 (14:30～17:30) "FBR Development and Fuel Cycle Policy--Reflections on the Monju Accident" [Panel discussion] ——Coffee Break——	SESSION 5 (14:00～17:00) "Nuclear Non-proliferation and Plutonium" [Panel discussion] ——Coffee Break——
	SESSION 1 (15:20～17:30) "Ten Years after Chernobyl--Its Consequences and Tasks" [Lectures]		
	JAIF CHAIRMAN'S RECEPTION (18:00～19:30) at Nagoya Kanko Hotel	DIALOGUE WITH THE PUBLIC (18:00～20:00) at Reception Hall	

THE 29TH JAIF ANNUAL CONFERENCE

April 17 - 19, 1996
Century Hall, Nagoya Congress Center

Basic Theme:
"Energy•Environment•Technology—What Can Nuclear Energy Do?"

WEDNESDAY, APRIL 17
***REGISTRATION** **9:00-**
at Century Hall, Nagoya Congress Center

***OPENING SESSION** **10:00-12:00**

Chairman:
Hiroji Ota President
Chubu Electric Power Co., Inc.

Remarks by Chairman of Program Committee
Tsuneo Iida Chairman of Program Committee;
Professor of Economics
International Research Center for Japanese Studies

JAIF Chairman's Address
Takashi Mukaibo Chairman
Japan Atomic Industrial Forum, Inc.

Remarks by Chairman of Atomic Energy Commission
Hidenao Nakagawa Minister of State for Science and Technology;
Chairman of Atomic Energy Commission

Lectures
"1996: A Milestone in the French Nuclear Program"
Yannick d'Escatha Administrator General
Commissariat à l'Energie Atomique
France

"The Process for Nuclear Elimination and Concrete Measures"
Richard Butler Ambassador to the United Nations
Australia

< Break >

13:30-15:00

Chairman:
Takeshi Nagano Director & Counselor
Mitsubishi Materials Corp.

Lectures
"Nuclear Regulation: The Challenges of Change"
Shirley Jackson Chairman
U.S. Nuclear Regulatory Commission
U.S.A.

"Science and Technology toward the Future"
Yoichiro Murakami — Professor
International Christian University

"The Indian Nuclear Programme"
R. Chidambaram — Chairman
Atomic Energy Commission
India

***SESSION 1 15:20-17:30**
"Ten Years after Chernobyl--Its Consequences and Tasks"

Chairman:
Rémy Carle — Chairman of the Governing Board
World Association of Nuclear Operators

Lectures

"One Decade after Chernobyl: Summing Up the Consequences"
Morris Rosen — Acting Deputy Director General
International Atomic Energy Agency

"How Chernobyl Accident Health Effect Research Should Be Understood"
Itsuzo Shigematsu — Chairman
Radiation Effects Research Foundation of Hiroshima and Nagasaki

"The Chernobyl Accident--Main Causes and the Safety of RBMK Plants"
Anselm Schaefer — Scientific Advisor to President
Gesellschaft für Anlagen und Reaktorsicherheit
Germany

Discussion with the audience

***JAIF Chairman's Reception 18:00-19:30**
at Banquet Hall "Nako," 3rd floor, Nagoya Kanko Hotel

THURSDAY, APRIL 18

***SESSION 2 9:00-12:00**
"Expanding Nuclear Power Programs in Asia"

Chairman:
Kunihiko Uematsu — Technical Advisor
Power Reactor and Nuclear Fuel Development Corp.;
Ex-Secretary General
Nuclear Energy Agency, OECD

Panel discussion

Yuanquan Zhou	Director General Bureau of International Cooperation China National Nuclear Corp.
Adiwardojo	Director Nuclear Energy Research Center National Atomic Energy Agency Indonesia
Yoshihiko Sumi	Director & Executive Vice President Kansai Electric Power Co., Inc.
Joo-Bo Hong	General Manager Nuclear Power Generation Dept. Korea Electric Power Corp.
Ishfaq Ahmad	Chairman Atomic Energy Commission Pakistan

Discussion with the audience

***LUNCHEON 12:15-14:15**
at Shirotori Hall, 1st Floor, Bldg. 4, Nagoya Congress Center

Remarks by Parliamentary Vice-Minister of International Trade and Industry
Kazutaka Tsuboi — Vice Minister of International Trade and Industry

Special lecture
"Advanced Technology for Mountain Climbing"
Michiko Imai — Doctor; Mountain Climber

***FILMS 13:00-14:00**
at Century Hall, Nagoya Congress Center

Latest films on Japan's nuclear research & development activities will be presented to those who will not be attending the Luncheon.

***SESSION 3 14:30-17:30**
"FBR Development and Fuel Cycle Policy--Reflections on the Monju Accident"

Chairman:
Hiroshi Murata — Vice Chairman, Japan Atomic Industrial Forum

Keynote
"How to Continue the R&D of FBR Overcoming the Aftereffects of the Secondary Sodium Leakage Incident at Monju"
Shunsuke Kondo — Professor, University of Tokyo

Panel discussion

Grahame Smith	Director of UK Group; Head of Sellafield Site, British Nuclear Fuel plc
Nikolai Ermakov	Head, Chief Administration for Development of Nuclear Reactors & Special Nuclear Plants, Russian Ministry of Atomic Energy
Marvin Miller	Senior Research Scientist, Dept. of Nuclear Engineering, Massachussets Institute of Technology, U.S.A.
Shunsuke Kondo	As above
Ryo Ikegame	Executive Vice President, Tokyo Electric Power Co., Inc.
Keiji Kobayashi	Instructor, Research Reactor Institute, Kyoto University

Commentators

Bertrand Barré	Director, Nuclear Reactor Division, Commissariat à l'Energie Atomique, France
Tadayoshi Suda	Executive Vice President, Power Reactor and Nuclear Fuel Development Corp.
Shinji Tamura	Senior Editorial Writer, The Chunichi Shimbun

Discussion with the audience

***DIALOGUE WITH THE PUBLIC 18:00-20:00**
on Nuclear Energy Development and Utlization
at Reception Hall, 4th floor, Bldg. 1, Nagoya Congress Center

Moderator:
Kazuhisa Mori — Executive Managing Director, Japan Atomic Industrial Forum

FRIDAY, APRIL 19

***SESSION 4 9:00-12:00**
"High-Level Waste Management--Promoting R&D and Consensus Building"

Chairman:
Nobuaki Kumagai — Professor Emeritus, Osaka University

Lectures

"On Developing Public Consensus for Undergroud Laboratory for Disposal of High-level Waste in France"
Maurice Allègre — Chairman, National Agency for Radioactive Wastes Management, France

"Building and Maintaining a Working Public Consensus: A Necessary Condition for Sustainable Progress in High-Level Waste Management in the United States"
Susan Wiltshire — Vice President, JK Research Associates, Inc., U.S.A.

"A Phased Strategy towards Implementation of a Swiss High Level Waste Repository"
Hans Issler — President, National Cooperative for the Disposal of Radioactive Waste, Switzerland

"The Swedish Programme for Implementation of Deep Geological Disposal"
Claes Thegerström — Director, Deep Repository Division, Swedish Nuclear Fuel & Waste Management Company, Sweden

"Strategies for Geological Disposal of High-level Radioactive Wastes--Overseas Experiences and Japan's Programme"
Atsuyuki Suzuki — Professor, University of Tokyo

Comment
Hiroshi Tsuchida — Mayor of Rokkasho-mura, Aomori Prefecture

Discussion with the audience

< Break >

***SESSION 5 14:00-17:00**
"Nuclear Non-proliferation and Plutonium"

Chairman:
David Rossin — Former President
American Nuclear Society

Keynote
"Plutonium and Proliferation: A 1996 Personal View"
Richard Garwin — Member of National Academy of Science;
IBM Fellow Emeritus
U.S.A.

Panel discussion

Richard Butler	Ambassador to the United Nations Australia
Richard Garwin	As above
Ryukichi Imai	Senior Advisor Japan Atomic Industrial Forum, Inc.; Professor Kyorin Unisversity
Joaquin Mercado	Director General for the United Nations Affairs Ministry of Foreign Affairs Mexico
Mingquan Zhu	Professor Center for American Studies Fudan University China

Discussion with the audience

Wednesday, April 17

Opening Session 10:00-15:00 [Lectures]

1996

A MILESTONE IN THE FRENCH NUCLEAR PROGRAM

Yannick d'Escatha, Administrator General, CEA

At the beginning of the 1970's, French authorities launched an ambitious nuclear power program designed to significantly increase France's independence with respect to energy resources. Right from the start, this program was conceived with the long term in mind. Therefore, in parallel to building up a pressurized water nuclear reactor park, a program for developing the reprocessing - recycling industry and the fast neutron reactor system was implemented. The appropriateness of these choices, which guarantee that future energy requirements will be ensured while optimising waste management, is being demonstrated over the long term. However, the change in the world's economic context with, in particular, the slackened development of nuclear power (aside from Japan and France) and the drop in the cost of uranium, has entailed a change of direction in the use of the tools implemented in order to better adapt to this new environment. Thus, French strategy consists in obtaining the means to recycle plutonium on account of its high energy value (1 gram of plutonium is equivalent to 1 ton of oil) and to oversee its management while preserving future choices. The industrial commissioning of COGEMA's MELOX plant thus appears as a major step in the French nuclear power program. Indeed, it marks the truly industrial startup of plutonium recycling.

The French nuclear industry has therefore endowed itself with the means to enhance the energy potential of plutonium and to control its stockpile. With Electricité de France's (EDF) 28 pressurized water reactors of 900 Mwe which technically may be loaded with 30 % MOX fuel, and owing to the French MOX fuel fabrication capacity, all the plutonium produced in the EDF park (in low enriched uranium fuel) can be recycled once as MOX. This reprocessing - recycling saves on natural uranium and separative work units (enrichment), allows to reduce the amount of plutonium generated as well as the number of spent fuel elements (those which contain the plutonium) stored in pools, while optimising the management of terminal wastes. This single recycling, advantageous and sufficient in a first step, paves the way, over a longer term, for multirecycling in pressurized water reactors or fast neutron reactors and the complete closure of the fuel cycle. The French safety authority has already given its go-ahead for the MOX fuel operation of 16 reactors, 7 of which are already loaded with 30 % MOX. Moreover, the authorization procedure concerning 12 other reactors is in progress. As a first step, the number of EDF reactors effectively supplied with MOX fuel should progressively increase from 9 in 1996 to 16 in 1998. It should be recalled that an experimental campaign in La Hague demonstrated the feasibility of reprocessing spent MOX fuel with the PUREX process.

Enhancing the value of plutonium as MOX fuel therefore appears to be a reliable and economical industrial solution that would ensure the balance of plutonium fluxes at the medium term. The performances of this system and of the industrial tool (fuel cycle and reactors) will be enhanced thanks to current research and development bearing mainly on :

- increased fuel burn-up : the goal is equal performance of MOX and UO2 fuels. This would allow to increase the burn-up of the fuel and to extend the time between reloadings, thereby providing considerable savings, as well as to streamline the management of core reloadings. Indeed, this is rather complex today since maximum burn-ups are different between MOX and UO2 fuels, resulting in different reloading periods,

- optimization of the MOX fuel fabrication process. Besides increasing burn-up, fabrication costs must be reduced, and, when the time comes, the reprocessing of spent MOX fuels must be simplified,

- the fine modelling of the neutronics of MOX cores, more complex than that of UO2 cores. These studies are aimed at increasing the MOX load from 30 % to 50 % and even 100 % in the new generation reactor EPR (European Pressurized Water Reactor).

At a longer term, -as on recycling spans a dozen years- complete closure of the fuel cycle requires the use of fast neutron reactors. Indeed, the number of possible recyclings of plutonium in a light water reactor is limited by the degradation in the isotopic quality of the plutonium and the formation of minor actinides which contribute to increasing the radiotoxicity of the waste. Fast reactors are potentially able to complete the consumption of degraded plutonium and to destroy minor actinides. With Superphénix and Phénix, France has invaluable tools to carry out the Knowledge Acquisition Program consisting in developing and industrially qualifying the solutions to attain these goals, in the framework of the CAPRA (french acronym for increased consumption of plutonium in fast reactors) and SPIN (SeParation and INcineration of long lived fission products) programs.

As concerns the reprocessing of spent fuel, the French industrial tool has now reached its maturity with the reprocessing operations in La Hague, now operating at full capacity under excellent conditions. Let us recall that one of the goals of reprocessing is also to simplify waste management, both quantitatively and qualitatively :

- quantitatively since the volume of long-lived waste arisings in the case of the reprocessing of spent fuel elements, which is currently $1 m^3$/ton of heavy metal, will further decrease, thanks to improvements under way, to below 0.5 m^3/ton, a value significantly lower than what is anticipated in the case of direct disposal of spent fuel elements ;

- qualitatively since it enables the various terminal wastes to be separated and to adopt optimized management for each type of waste : vitrification for fission products, specific conditioning or transmutation for minor actinides, terminal disposal for low activity wastes, etc.

France's research on the management of high activity and long-lived wastes results from the December 30, 1991 law. This law provides for Parliament to make a decision at the end of a 15-year period of research bearing on three main subjects :

- separation and transmutation of long-lived wastes ;

- disposal in deep geological formations, particularly with the construction of underground laboratories. This year the Government should select the sites among those proposed ;

- conditioning of waste and long duration surface interim storage.

Studies on the management of long-lived wastes show that the main contributor to the radiotoxicity of spent fuel elements is plutonium. The reprocessing - recycling strategy which aims at consuming the plutonium while producing electricity therefore offers definite advantages where environmental protection is concerned.

Similarly, the consumption and degrading of weapons-grade plutonium from the dismantling of weapons, while producing electricity, offers considerable advantages in the fight against proliferation.

These advantages, in terms of long-lived waste management and in terms of non-proliferation, come in addition to the primary reason for reprocessing - recycling plutonium which is to enable the use of the totality of natural uranium and not only its U235 isotope (which represents only 0.7 %). This is why the technology of fast neutron reactors has been developed, particularly by France and Japan which both consider that nuclear energy is indispensable for their long term energy supply. Indeed, totally consumed, uranium can provide humanity with centuries of abundant, inexpensive, safe, clean energy and without any emission of greenhouse effect gases.

The Process for Nuclear Elimination and Concrete Measures

Richard Butler
Ambassador to the United Nations
Australia

NUCLEAR REGULATION: THE CHALLENGES OF CHANGE

BY
DR. SHIRLEY ANN JACKSON, CHAIRMAN
U.S. NUCLEAR REGULATORY COMMISSION

TO
THE JAPAN ATOMIC INDUSTRIAL FORUM
NAGOYA, JAPAN
APRIL 17, 1996

ABSTRACT

In the United States, as is happening globally, change in the nuclear energy sector is being driven by sometimes conflicting forces in four areas:

(1) economic constraints and the restructuring of the electricity industry; (2) the changing role of government; (3) regulation of a maturing industry; and (4) technological innovation. The common thread running through these issues is positioning for change. Ignoring change may pose risks to public health and safety. Accepting the inevitability of and managing change requires a focus on defining and implementing long term, well thought out approaches to common issues, with an emphasis on cooperative efforts and greater transparency in our activities. This approach will challenge human and infrastructural resources. It requires vision, and constant political will.. A proactive, transparent, cooperative approach has the best chance of maintaining nuclear power as a viable energy alternative, supported by a public which believes that its essential health and safety concerns are taken into account. I will address how we, together, might approach the four-fold changes I have outlined.

Science and Technology toward Future

Murakami, Yoichiro P.
International Christian University

Modern science can be roughly categorized into three types, which appeared in chronological order in history. First, pre-scientific type started in the 17th century. The representatives are G. Galilei, R. Descartes, I. Newton and so forth. I am not ready to call them scientists. Of course, an English word 'scientist' was coined around 1840 by W. Whewell, so I. Newton, for instance, was never called 'scientist all through his life. Besides this, they pursued knowledge only to obtain clearer image of the Holy Design of Nature, that was created by God. Only when this feature was deprived from knowledge pursuit, science in our sense of the word was established. The process was encouraged by the philosophes in the Enlightenment era. I sometimes refer to the process by 'Secularization Revolution .

As a result of the 'Secularization Revolution' science in the second type, which will be called science in prototype, emerged in the 19th century. Scientists in this stage did not pursued knowledge for better understanding of the Holy Design any more. Instead they did it driven by their own curiosity. Those who shared similar curiosity formed scientific community of comparatively small size. Each scientific community published academic journal to which the members could submit their results of research in the form of papers. The papers chould and should be reviewed and read only by the members of the community, namely peers.
The responsibility and obligation of scientists in this type of science is only to obtain research outcome which can be appreciated by their peers. In short scientific community is quite closed and selfcontained. Naturally the support of outer society to science could only be philanthropical, just as in music, fine arts etc..

I do not say that science in prototype disappeared today. The third type, however, is now emerging, to which I will refer by new science or scientia nova, to avoid the confusion with 'new-aged science'. Some such as M. Gibbons are about to name this type of science as science in Mode 2. One of the features of the new science is that research is not curiosity-driven but mission-oriented. Missions do not emerge within any scientific community. They do in outer social sectors such as defence, industry, health related one, political one and so on.
Scientists take commission to accomplish these missions. Financial supports come directly from the sector related. Research as such can only be carried on by

appropriate configuration of researchers from various academic areas. In that sense science of this type is collectivistic rather than individualistic. As a result, scientific community cannot be so closed as in prototype in one way or other. Scientists are forced to be transdisciplinary. Scientists are responsible for those who comission them in accomplishing the mission in an effective way. At the same time they have to be responsible for the whole society, because the mission they accomplished might be harmful to the benefit of the whole society. In other words, scientists are requested to take into consideration the things which are not related with their own research areas. They have accountability toward the non-experts.

The roles of the non-experts should change as well. They are requested to understand what scientists explain, and more or less responsible for the results of the projects which are carried on by scientists as members of the whole society.

I am not saying that science in prototype does disapper in future. Coexistent era of the two will continue in a long run. But we are strongly advised to recognize that science (at least a considerable part of it) is really changing its characters, and the traditional framework for scientific reseaerch is now obsolete.

The Indian Nuclear Programme

by
R. Chidambaram
Chairman, Atomic Energy Commission, India

Abstract

Nuclear energy offers the promise of energy security in a world of disparities in terms of distribution of energy resources. This promise arises out of larger calorific value of nuclear fuels and the possibility of breeding. Also nuclear energy is a clean source of energy with little adverse impact on the local, regional and global environment. It is our firm conclusion that recycling plutonium and if possible later, minor actinides, not only enhances the energy resource potential but also considerably simplifies management of nuclear wastes both in short term and in long term. Thus nuclear energy development is of crucial importance particulary in regions which are energy starved not only from the point of ensuring equitable availability of energy and through its opportunities for progress but also for minimising additional environmental impact.

The Indian nuclear power programme is tailored to suit our own nuclear resource profile and is consistent with a rational global policy that should be adopted based on considerations given above.

The Indian nuclear power programme is based on Pressurised Heavy Water Reactors--eight of which are under operation and four under construction. These are 220 MWe reactors, for which we now have a standardised design. A fully indigenous PHWR design of 500 MWe is now available and technology development for it is also complete and construction of two units based on this desing will start shortly. The plutonium produced in these reactors will be used in fast breeder reactors with thorium blankets. A Fast Breeder Test Reactor has been in operation for ten years and technology development for a Prototype Fast Breeder Reactor of 500 MWe is in progress. When enough U-233 is available, it is possible to think of a Thorium U-233 cycle. The closed fuel cycle is considered essential for sustainable development of nuclear energy in India. The nuclear fuel cycle capabilities range from prospecting and mining for uranium and thorium fuel fabrication, reactor design and maintenance, heavy water production, reprocessing and nuclear waste management. A great deal of attention is paid to safety and to health and environmnetal protection.

India's first research reactor APSARA was built in 1956. Since then, several research reactors using natural uranium, plutonium and U-233 have been built. The biggest 100 MWt research reactor DHRUVA commissioned in 1985 uses metallic natural uranium as fuel and heavy water as both moderator and coolant and is now the main source for production of radioisotopes and for neutron beam research. The Department of Atomic Energy also supports development in other high technology areas like lasers and accelerators and a synchrotron radiation facility is presently under construction. It also supports basic research in a wide range of disciplines of relevance to atomic energy.

India was one of the founder members of IAEA and has co-operation agreements with many countries. The Regional Cooperation Agreement (RCA) of IAEA, which currently comprises 15 countries, originated with the India-Philippines Agency (IPA) Project of the early sixties, which was essentially directed towards utilisation of existing research reactors in the region and is now a model for such Agreements of Cooperation in the field of nuclear energy and its applications.

[Memo]

Session 1 15:20-17:30 [Lectures]

"Ten Years after Chernobyl--Its Consequences and Tasks"

The accident at Chernobyl Nuclear Power Plant Unit 4 in April 1986 released a huge quantity of radioactive materials across Ukraine and neighboring countries. Not only did the accident affect the human environment, but it also detracted from the credibility of nuclear power around the world. Now, one decade since the accident, in this session it is important to assess the health effects of the consequences of Chernobyl, and study the causes of the accident to ensure that further encouragement is given to R&D on nuclear power and safety.

The session will also feature a report of the results of "One Decade After the Chernobyl: Summing Up the Consequence of the Accident," an international meeting scheduled from April 8, 1996, sponsored by the European Union, the World Health Organization and the International Atomic Energy Agency. Also, a radiological study on health effects in the contaminated areas will be discussed from a scientific point of view to verify what has so far become known and what remains to be solved in the future.

JAIF Chairman's Reception 18:00-19:30

at Banquet Hall "Nako," 3rd floor, Nagoya Kanko Hotel

One Decade After Chernobyl: Summing Up the Consequences

Morris Rosen
Acting Deputy Director General
International Atomic Energy Agency

Based on the background papers prepared for the Chernobyl Conference held in Vienna 8-12 April, the international consensus that now exists on the consequences of the accident is outlined. The paper describes the factual and realistic understating of the current and future impact of the accident. It not only quantifies the accident's actual consequences, but also reviews the social, economic and political aftermath. The various improvements in nuclear safety that followed the accident are summarized.

The paper will specifically cover the health effects that can be attributed to radiation exposure--clinically observed, thyroid cancers and epidemiological estimated effects--and other health related effect such as psychological consequences, stress and anxiety along with the environmental consequences. The accident's consequences will be put into perspective and a prognosis for the future presented.

How Chernobyl Accident Health Effect Research Should be Understood

Itsuzo Shigematsu
Chairman
Radiation Effects Research Foundation

The accident that occurred on 26 April 1986 (Saturday) at the Chernobyl nuclear power plant in the former Soviet Union is reported to be the largest of this kind in the history of nuclear power generation. It has left many lessons to learn for the nuclear power industry both in terms of hardware and software. The accident also brought about extensive environmental pollution due to radiation and gave rise to serious health effect problems involving those who touched or were touched by the accident and the general public as well.

Immediately after the accident, the former Soviet government developed and implemented measures for protection against the risks of radiation exposure and conducted research of radiation health effects. These undertakings were succeeded by the republics of Russia, Ukraine, and Belarus after the fall of the Soviet regime in December 1991. However, since research has been conducted independently by the three republics, confusion has arisen due to competition and duplication of cooperative activities among the international organizations, including the International Atomic Energy Agency (IAEA), World Health Organization (WHO), and Committee of European Community (CEC) and various countries, including Japan.

Much has been reported by the mass media on the health effects that have developed after the accident. It is no exaggeration to say that many of such reports are unscientific, disregarding the association with radiation exposure. From this point of view, the "Assessment of Radiological Consequences and Evaluation of Protective Measures" of the "International Chernobyl Project" released by IAEA in May 1991 with the participation of about 200 experts worldwide for about a year was considered to be, at that time, the most reliable scientific report.

Recently, efforts are being made vigorously to reconstruct the radiation doses attributable to the Chernobyl accident, using biological methods and others. Researchers in Japan are also actively contributing to the estimation of radiation doses. In this connection, an international workshop was held in Badhonnef, Germany in June 1994. It is my pleasure to see an international cooperation system established for the estimation of individual radiation doses.

One of the health effects of the Chernobyl accident that is drawing the greatest attention is childhood thyroid cancer, the frequent occurrence of which has often been reported especially from Belarus and Ukraine. Even in the recent years alone, WHO, IAEA, and Nagasaki University held independently international workshops to discuss this issue and came to a common conclusion that, despite the observed increase of childhood thyroid cancer, its relationship with radiation still remains to be defined. In view of this also, reconstruction of radiation doses mentioned above is an urgent task, especially for childhood thyroid.

In addition to thyroid cancer, such health effects as leukemia, malformation including brain damage, and psycho-neurological problems are being studied by WHO's "International Programme on the Health Effects of the Chernobyl Accident (IPHECA)" initiated in 1992 with the cooperation of various countries. In July 1994, the "Study of Chernobyl Accident Liquidators (Cleanup Workers)" was added to the IPHECA's projects. The supporting structure of each project is not well built yet. We must wait for further efforts.

On the other hand, under the Chernobyl Sasakawa Project initiated in 1991 with a budget of 5 billion yen, examination centers were established at five locations in cooperation with the three republics and examinations consisting of whole-body radiation counting, thyroid diagnosis, and hematological tests were conducted for more than 150,000 children aged 10 or less. The project is expected to complete its 5-year plan in April this year. This project is characterized by its employment of the identical equipment and procedures at all examination centers in the three republics and has provided useful data for the evaluation of health effects of the Chernobyl accident.

April of this year (1996) marks the 10th anniversary of the Chernobyl accident. On this occasion, to summarize and evaluate the health effects that have developed during the past 10 years, an international conference was held by WHO and others in November 1995 in Geneva with the participation of about 600 researchers and administrative officials from 59 countries. For a similar purpose, an international conference will also be held in late March this year by European Commission and others in Minsk, Belarus, and a meeting in commemoration of the 10th anniversary of the accident will be held by IAEA and others in Vienna from 8 to 12 April 1996.

Today, I would like to confine my report to the results of the surveys of health effects that have been brought to light through these meetings.

The Chernobyl Accident
Main Causes and the Safety of RBMK Plants

A. Birkhofer, A. Schaefer
Gesellschaft für Anlagen
und Reaktorsicherheit(GRS) mbH

Summary

Ten years of investigations into the causes of the Chernobyl accident have led to a consensus on most issues. There are still open questions regarding some details of the course of the accident. Nevertheless, the knowledge accumulated is sufficient for defining effective measures in order to prevent such accidents in the future.

Immediately after the accident, the role of violations by operators of procedures and rules was widely discussed. Today, it is recognized that the main causes were severe design deficiencies: a nuclear core design leading to a large positive void effect of reactivity and an inadequate control and protection system with a control rod design resulting in an increase of reactivity when the rods were inserted into the reactor core in conditions existing before the accident.

Already relatively soon after the Soviet Union changed these features of the core design and of the control and protection system. The positive void effect was significantly reduced. This was done in 2 stages. In the first stage, additional neutron absorbers were introduced into the core instead of fuel assemblies and the operating reactivity margin was increased to 43-48 control rods. In a second stage the fuel enrichment was increased from 2.0% U-235 fuel to a value around 2.4% U-235.

These backfits were essentially performed at all RBMK units. The actual values of the void effect of reactivity are below 1β at normal operating conditions. Another Chernobyl-type reactivity accident with large off-site impact seems no longer possible under these conditions. Nevertheless, there still exist initiators for reactivity accidents. The most significant example seems to be a voiding of the control rod system cooling circuit. Monitoring and control of this system has been improved. Nevertheless further backfits are required regarding the prevention of reactivity accidents.

The original design of RBMK plants has also raised safety concerns in other areas:

- safety systems for assuring core cooling and confinement of radioactive material during accidents,

- the protection against hazards such as fire and flood.

In these areas, the concepts and safety features have been considerably improved with the development of successive RBMK generations. However, large deficiencies are found with the original design of the first RBMK-generation. There exist upgrading programs which aim, as far as possible, at meeting

current safety objectives. For some RBMK units, these programs are pursued systematically. When completed, they will lead to significant safety improvements.

The RBMK units still operating at Chernobyl have basically undergone the same backfits as other comparable RBMK plants. Some delays are due to demotivations related to earlier discussions and decisions on a decommissioning of the Chernobyl nuclear power station. Other Chernobyl specific safety concerns related to

- the close connection between the third unit and the destroyed reactor,
- the shelter confining the destroyed reactor,
- and the radioactive materials provisionally buried at the site.

Many investigations were carried out during the recent years about potential safety problems with the shelter and its internals: composition and behavior of the "fuel lava", possible recriticality phenomena, migration of radionuclides, possibility of internal explosions, impact of earthquakes, and the consequences of a potential collapse. It turned out that the shelter's stability cannot be sufficiently assured in the long run but that, on the other hand, consequences would be limited to the near vicinity of the plant even in the event of a collapse of the shelter.

[Memo]

Thursday, April 18

Session 2 9:00-12:00 [Panel discussion]

"Expanding Nuclear Power Programs in Asia"

Asia is undergoing remarkable economic development, causing a significant surge in its demand for energy. The population of Asia is expected to continue increasing, also underscoring the urgent need for securing a stable supply of energy. At present, each Asian nation is developing a diverse range of energy sources in coordination with its industrial conditions. In particular, nuclear power with a less burden on the environment, serves the interests of Asia. Countries already with nuclear power plants in operation are making vigorous programs for its further development, and those without plants considering to introduce it.

Asian nations are expected to play a leading role in socio-economic development in the next century. Particular in recent years, nuclear power development programs in Asia are expanding, with extensive international cooperation

This session will confirm their aspirations and expectations for nuclear power in Asia, outlining their programs for its further promotion and introduction. It will also explore possibilities for cooperation to help enable the programs of the Asian countries to make sound and steady progress.

Yuanquan Zhou
Director General
Bureau of International Cooperation
China National Nuclear Corporation

Prospect and Potential of Nuclear Power Plant in Indonesia

Adiwardojo
Director
Nuclear Energy Research Center
National Atomic Energy Agency
Indonesia

- Summary -

Developing Nuclear Power Generation in Asia

Yoshihiko Sumi
The Kansai Electric Power Co., Inc.

(Introduction)

Asia has achieved rapid economy growth accompanied with strong energy demand. To meet ever-increasing energy demand, China, Republic of Korea, Taiwan, India, Pakistan as well as Japan have been utilizing nuclear power generation. And Indonesia is considering the introduction of nuclear power generation in the near future.

When developing and utilizing nuclear power, the country concerned should primarily take responsibility for solving each nuclear related issue. However, nuclear power, as an technology based energy source, is the common heritage of mankind to be shared by the international community, and includes some common problems to be solved through bilateral or multilateral cooperation.

I would like to talk about conditions and methods that could be taken to steadily and soundly develop nuclear power generation in Asia.

(Subjects to Develop Nuclear Power Generation)

The first issue to be addressed is ensuring safety. It is needless to say that ensuring nuclear safety is the crucial issue. For this purpose, safety culture should be cultivated and attitudes to put overriding priority on nuclear safety should be established. It is also important to give thoughtful consideration to the human factors. In addition, the basic requirements of nuclear power development include participation in an international framework to ensure safety, such as the Convention on Nuclear Safety, that sets an international standard to ensure nuclear safety, and systematic preparation of safety guidelines and safety regulations.

The second issue is to assure the nuclear non-proliferation. Nuclear power was originally developed for military purposes. Assurance of nuclear non-proliferation is

an absolute requirement for each country to be allowed peaceful use of nuclear energy. International frameworks with the Treaty on the Non-Proliferation of Nuclear Weapons as the core structure, is established. Such a scheme is secured by accepting the IAEA's full scope safeguards and by observing Convention on the Physical Protection of Nuclear Material.

The third issue is the back-end options. Asian nuclear countries have been troubled with the disposal of radioactive waste. Siting the repository in the countries concerned is fundamental to radioactive waste management and disposal issue. The possibility of international cooperation in the comprehensive management and disposal of radioactive waste might be expected as an option in the distant future. Treatment of spent fuel may be handled in the same manner.

The fourth issue is the obtaining of public understanding and trust. No nuclear power project will truly be developed until each country obtains public confidence. The showing of a satisfactory performance of safe and stable operation along with the openness of information are essential to build public confidence. It must be borne in mind that it takes many years to gain public confidence, but it only takes a moment to lose it through an accident or concealment of information. International cooperation to obtain public confidence is also important.

The fifth issue is cost effectiveness. It is necessary to improve the cost effectiveness of nuclear power while not only simply comparing costs between nuclear energy and other available energy options in such countries, but also by considering balance in energy demand and supply. Countries which are poor in natural resources, such as Japan, must allow an additional security cost to ensure stable energy supply.

(International Cooperation)

Multilateral cooperation as well as bilateral cooperation in Asia is necessary to deal with such issues as discussed above. It will be more important to consider the characteristics of Asian countries. Asia is not a group of homogeneous countries like Europe. Asia countries are characterized by diversified status with various socio-economic systems and different levels of natural resources and technical development. In light of Asian diversity, it would be appropriate to begin with talks on an equal

footing. It would be practical to start discussions over the nuclear safety, then extend to nuclear non-proliferation, back-end options, etc. The framework of multilateral cooperation would be useful. I think, when all countries have been developed to more equal level, such multilateral framework could become an organization, so-called ASIATOM or Pacific-ATOM, which is an Asian version of EURATOM. For the scope of the cooperation, it is suitable to extend to the Pacific areas including the U.S., Canada and Australia, which have a strong relationship geographically and economically with Asia.

Bilateral cooperation is also important in Asia. To date, Japan has signed the nuclear cooperation agreement only with China and has exchanged the note concerning nuclear cooperation with Republic of Korea. Bilateral cooperation through the Nuclear Cooperation Agreement will become more necessary in the future.

(In conclusion, Japan's Nuclear Power Development Policy)

Japan's energy policy is based on two key phrases, such as long-term prospects and the global energy security. Since Japan is poor in natural resources, Japan will continue to make an effort to promote the peaceful use of nuclear power.

Japan , as an Asian country, has determined to cooperate with nuclear power development in Asia based on the policies of ensuring safety and non-proliferation. The Japanese government has clarified its stance favoring nuclear development in Asia. As an electric utility, we hope to cooperate with Asian utilities, making the most use of our experience in nuclear power generation.

Joo-Bo Hong
General Manager
Nuclear Power Generation Department
Korea Electric Power Corporation

Need for Nuclear Power in Pakistan and International Cooperation

Ishfaq Ahmad

Pakistan Atomic Energy Commission

Pakistan is passing through an energy-intensive phase of socio-economic development and will need large inputs of energy in the coming years for sustaining its pace of socio-economic development and satisfying the growing aspirations of its rapidly increasing population. However, inspite of the fact that the current level of energy and electricity consumption in Pakistan is much below the world norms, the country is heavily dependent on energy imports, resulting in serious balance of payment difficulties. In order to meet its rapidly growing energy needs in the wake of limited energy resource endowments, Pakistan needs to follow a policy which seeks diversification of supply sources and emphasizes equally the development of all available forms of energy: fossil fuels, nuclear power, hydro, and other renewables.

The present installed power generation capacity in the country is about 13,000 MW. This is expected to increase to about 40,000 MW by the year 2010 and 80,000 by 2020. However, the indigenous resources of fossil fuels and hydro power will not be able to cope with these requirements so that a gap of some 15,000 MW in the year 2010 increasing possibly to over 40,000 MW by 2020 will have to be filled in by building plants based on imported fossil fuels or nuclear power. In order to contain its dependence on imported fossil fuels, Pakistan needs to make increasingly large use of nuclear power in the coming decades. A start in this direction was made in 1971 with the construction of a 137 MW nuclear power plant, KANUPP. The plant has now completed 24 years of satisfactory operation. Work on the construction of a second nuclear power plant, CHASNUPP, of 300 MW capacity was started in 1992 and this plant is expected to become operational in late 1998. For further development of nuclear power Pakistan looks for greater international cooperation, in particular for close cooperation among the Asian countries.

Taking the lead from Japan and Republic of Korea, a number of energy resource-poor Asian countries are now eagerly interested in making large scale use of nuclear power in order to overcome their energy supply difficulties. But establishment of the necessary infrastructure for nuclear power development in a self-reliant manner is beyond the technical and financial resources of most of these countries. However, if the Asian countries pool up their resources to set up joint

R&D facilities for the development of nuclear power plants and related fuel cycle facilities, it will greatly help nuclear power development in each of them as the EURATOM arrangement did in the case of countries of Western Europe in the 1960s and 1970s. Such a cooperative arrangement will not only be more cost effective, it will lead to development of nuclear power technology in the region in a reliable, efficient and transparent manner and will also help to reduce the existing suspicions and hostilities between certain countries within this region. It is therefore proposed that the Asian countries establish a regional cooperative arrangement, on the lines of EURATOM, for the development and promotion of nuclear power technology within the region and a leading role in this respect be played by Japan and Republic of Korea, the two countries which have already achieved a high degree of expertise in this area.

[Memo]

[Memo]

Luncheon 12:15-14:15
at Shirotori Hall, 1st floor, Bldg. 4, Nagoya Congress Center

Special Lecture

Films 13:00-14:00
at Century Hall, Nagoya Congress Hall

Advanced Technology for Mountain Climbing

Michiko Imai
Doctor; Mountain Climber

[Memo]

Session 3 14:30-17:30 [Panel discussion]

"FBR Development and Fuel Cycle Policy--Reflections on the Monju Accident"

Japan's basic policy of nuclear fuel recycling--reprocessing spent fuel and recycling recovered plutonium--has been formulated to ensure the efficient use of resources and the appropriate management and disposal of radioactive wastes. The policy is dependent on the further development of fast reactor technology. The prototype reactor "Monju" has been constructed based on the experiences at the experimental reactor "Joyo" for establishing a commercial technology.

However, a sodium leak in "Monju" last December has brought the project to a halt until the cause of the accident is identified. The lesson of the "Monju" accident will give this session an occasion to verify what has so far been achieved in the technology as a step toward the commercialization of FBR early in the 21st century, and discuss tasks for pursuing the recycling policy.

Also in this session, discussions will be held about how to pursue such a large-scaled project while reflecting the views and opinions of local people, the public and experts from various sectors of science, which is thought to be necessary to smooth the way for carrying out the plan over a long time-frame.

How to Continue the R&D of FBR Overcoming the Aftereffects of the Secondary Sodium Leakage Incident at Monju

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On December 8, 1995, a secondary sodium leakage incident occurred at Monju, a prototype LMFBR which was in the final stage of commissioning test and operated at 40% of rated power for the loss of load test. About 0.7 tons of sodium were leaked into the secondary sodium piping room located just outside of the containment through the failed thermocouple sheath installed in the pipe of secondary coolant loop C and caused not only the damage of auxiliary structures below the leakage point due to sodium fire but also widespread deposition of sodium oxide in the secondary sodium system building. The cause of the failure of the sheath was high cycle fatigue due to resonant flow induced vibration of it owing to the design failure to properly consider the possibility. The significance of the event from the viewpoint of nuclear safety was level 0 or 1 of INES scale and as for the significance from industrial hazard viewpoint, the fire department of local government judged the event as a small scale fire.

The press coverage of this event, however, was disproportionately intensive due partly to the confusion of the PNC, the operator as well as the developer of the plant, in supplying relevant information to the press and this caused various public reactions including the joint proposal of three prefectural governors to prime minister to reconsider the policy of pursuing recycle use of nuclear material, first by plutonium recycle in LWRs and then by LMFBRs when the technology is matured. The potential cause of this turbulent social situation might be the reduction of tolerance in the public mind to risk due to a loss of balance in mind that had occurred as a sequelae of their experience of two unusual events last year, one natural and the other artificial. It can also be pointed out that another cause lies in the defect in the public information activity of the government and the PNC, both of which obviously concentrated on the issues related to nuclear nonproliferation and lacked consideration to the sensitivity of the local public to the utilization of sodium, during and after the revision of the Atomic Energy Commission's long term plan for research, development and utilization of nuclear energy in 1994. The nuclear establishment should learn from the current situation a bitter lesson that their public information activities should be comprehensive, never forgetting to think locally, especially in such volatile political situations Japan experiences at present since they cannot set the agenda for public debate.

Nonetheless, it is difficult so far to find in this incident itself something that poses need for substantial changes in the current policy including the pursuance of the commercialization of the technology for recycling use of nuclear material. The developers of LMFBR in the world have experienced various sodium leakage incidents already and accumulated the know-how to take this type of incidents into consideration of its design and operation. There is also no basis in this incident for the depreciation of the importance of LMFBR technology which can supply vast amount of energy without emitting greenhouse effect gas and contribute to the sustainable development of humankind far into the future. The

public and the developers will therefore be able to share it as a common understanding when the former recover from the sequelae that to experience these incidents and improve the technology based on them is the very reason this prototype plant was constructed far before the real need arise.

For the time being, however, the government and the PNC should learn as many lessons as they can and give serious consideration to the following four points at least for resolving a kind of stalemate in which Japanese nuclear fuel cycle activities including LMFBR development are currently trapped.

(1) The government should provide the public with a precise evaluation of the incident which includes comprehensive measures to improve not only the robustness of Monju to sodium leakage but also the LMFBR technology in general as a safe and reliable power generation technology for future use. Although past sodium leakage events have generally been small scale and of no consequences, it is useful at this occasion to review appropriate measures to be taken to prevent the leakage itself and those to mitigate the consequence on the other not only for assuring the safety of the public but also for reducing the financial damage of the operator due to the event as low as practicable. It seems that the LMFBR community can still learn many lessons even from a serious sodium fire event at the solar power facility at Igualija, Spain in 1986.

(2) PNC should establish its safety culture necessary for a NPP operating organization. PNC has been a unique R&D organization for a long time. As it starts operation of nuclear power station, however, they should review their conformance with all the requirements for a nuclear power plant operator including the IAEA Basic Safety Principles. It should also strengthen its interface with general and local public for communication as electric utilities have already done so. Furthermore, it is essential for the PNC to establish an organizational culture to understand the public uneasiness to plutonium and sodium caused by wide press coverage and the photos of ugly wreck caused by sodium fire at Monju and to appreciate the open-mindedness of the public who accepts their R&D activity irrespective of it.

(3) The government should continuously communicate with the public the importance as well as the effectiveness of the public investment into the development of the LMFBR for sustainable development of future generation. Major developers except France, Russia and India have temporarily retired from the activity for the commercialization of LMFBR technology due primarily to the financial and/or political difficulty. It is obviously beneficial for humankind, however, to seek their involvement in this endeavor no matter how small their contribution might be. Japan should, in cooperation with France, Russia and other countries, to promote various international cooperative activities in this area, asking contribution of as many countries as possible including these countries temporarily retired.

(4) The government should consider the way to compensate the anxiety of the public to new things in the surrounding area of nuclear facility, even if the safety level of nuclear facilities is believed to be extraordinary high as compared with other facilities in the area, by establishing new safety net for general purpose and making the area one of the safest areas in Japan. This safety net should be basically an emergency preparedness for the everyday emergency in the area, which can demonstrably be useful also for the emergency in the nuclear facilities in the area.

ABSTRACT

LOCAL ACCEPTANCE AT A FUEL RECYCLE FACILITY IN THE UK AND LESSONS FOR INTERNATIONAL COOPERATION

Presentation by Grahame R Smith
Director UK Group, Head of Sellafield Site
BNFL

Public acceptance of nuclear power is something none of us in the nuclear industry - anywhere in the world - can take for granted. It is not given easily. Like loyalty or respect it has to be earned. Over the past 10 years or so BNFL staff at Sellafield have worked diligently to win public acceptance in the local community of West Cumbria.

Sellafield and its activities underpin the economy of that community. The site employs 7,000 people directly with a further 1,000 in contracting roles. Many other local jobs are also dependent on the site. This is a lot of jobs in an area which is one of the most rural in northern England. Most of Sellafield's employees live in the small towns and villages within a 15 mile radius of the site. Indeed some 70% of the workforce live in the local parliamentary constituency.

However this employment is not sufficient on its own to win public acceptance in the community.

In 1984 public perception of Sellafield was so badly damaged by a series of highly publicised incidents (the most severe of which was the contamination of beaches close to the site) that local opinion - and opinion amongst our workforce - was at a very low level.

Like the Monju incident - the beach incident as it became known, was not radiologically serious - still within authorised levels but the media and Greenpeace made it into a major nuclear accident. Again - like Monju - we did not have a technical problem but a presentational problem which required a communications solution.

Something had to be done to remedy this situation to repair the damage in public perception and a programme of public affairs activity was put into motion.

The objectives were simple and straight forward, to be open, honest and to be trusted. We opened the doors of Sellafield to the public; we were honest about mistakes which we made and we set about implementing procedures to ensure such events which led to that adverse publicity did not happen again. In public acceptance activities we identified our stakeholders - our audiences - who we needed to address.

We address our various audiences in different ways - tailoring the medium to suit their requirements. However, the basic messages remain the same.

We use the Sellafield Local Liaison Committee - with a wide cross section of local community leaders - as one of the main arenas to address issues which concern the community. We have regular meetings, both formal and social occasions, with the county, local borough, parish councils and our workforce. Each month the workforce is thoroughly briefed on all issues affecting the site by use of a core information brief.

We built a small Visitors Centre in the mid 1980s which was replaced by a £5 million centre in June 1988. This facility attracted over 150,000 visitors a year. It also became a major tourist attraction in West Cumbria. In June 1995 we reopened the Visitors Centre after a £5 million refurbishment programme. In its first six months it attracted over 100,000 visitors including 39,000 in one month alone.

We also encourage visitors to the Centre to take a tour of the Sellafield site. We introduced guided tours to plants on site. In addition we have a Speakers Panel Talks Service.

We meet formally and socially with all sectors of the community - police, church leaders, educationalists, industrialists from other industries, landowners, farmers, fishermen, in fact anyone who wishes questions answered or have points to make.

We encourage staff to be involved in community activities. Many are elected to local councils and hold senior office; many are school governors. We provide substantial sponsorship to a wide range of charitable organisations in the community.

We respond favourably to media requests to visit Sellafield and are eager to assist the media in following up enquiries. We work particularly closely with the media in our community.

The second part of our community programme relates to money and the financial aid we have given to the local communities.

In 1988 the West Cumbria Partnership was formed as an alliance between BNFL, the local and county councils, government agencies and private industry.

The Partnership to date has created or safeguarded over 3,000 jobs, and over 500 business start-ups. The flagship scheme of the Partnership is the Westlakes Science and Technology Park which is a developing success focused on the growth of knowledge-based business and academic excellence in the area. Westlakes has attracted 20 firms, employing over 250 people in totality on the Park, and through the Westlakes Research Institute is developing environmental commercial research underpinned by academic understanding, towards the growth of business enterprise and university status in West Cumbria.

Winning public acceptance in our rather remote community cannot be attributed to one single factor but to a combination of factors and to painstaking attention to detail. Continuously communicating with people, gaining their confidence, winning their trust.

BNFL's role in the county is to underpin the economic fabric of West Cumbria through on going employment, combined with our financial help through the West Cumbria Development Fund. But that is only part of the equation. Everything we do in our activity is geared to retaining and gaining public acceptance.

Nikolai Ermakov
Head
Chief Adminstration for Development of
Nuclear Reactors & Special Nuclear Plants
Russian Ministry of Atomic Energy

Can We Live With/Without the Breeder Reactor?

Marvin Miller
Department of Nuclear Engineering
and
Center for International Studies
Massachusetts Institute of Technology

Nuclear power, as embodied primarily in the light water reactor (LWR), is now a significant source of electricity in many industrialized countries. However, its future is uncertain because of continued public concerns about reactor safety and radioactive waste disposal. Such concerns have led to difficulties in siting new reactors and waste disposal facilities even in countries where the cost of new nuclear generation is still competitive with fossil fuels. In addition, the concern that international safeguards alone are inadequate to prevent the misuse of ostensibly peaceful nuclear activities to make nuclear weapons has grown recently. This is because of recent events in Iraq and North Korea, as well as the plans of countries such as Japan for continued development of the plutonium breeder reactor.

The case for the breeder as a hedge against potential greenhouse warming due to fossil fuel combustion is based on the view that available terrestrial uranium resources are insufficient to support the large nuclear capacity required if the reactors are converters such as the LWR. However, it would be both naive and dangerous to expect that the current system of international safeguards would suffice to prevent diversion of significant quantities of plutonium from flows on the order of millions of kilograms corresponding to thousands of GWe of installed breeder capacity. Only a regime in which all sensitive facilities would be in heavily guarded "nuclear parks" under international control could reduce the risks of proliferation and sub-national diversion to a sufficient degree. But placing the nuclear component of their electricity supply under international control would run counter to the major rationale for deploying breeders in countries such as Japan: energy independence.

Moreover, it is highly unlikely that the publics in democratic states would accept large-scale deployment of reactors whose safety is based on the validity of probabilistic risk assessments.
Rather, a necessary condition for future deployment of nuclear power on a large-scale is that the reactors be reliable and transparently safe against core melts caused by accidents or malign intent. In addition, it would be prudent not to have to rely on severe security measures to minimize proliferation risks. At

present, this favors once-through fuel cycles using low-enriched uranium. Although the uranium utilization of such cycles is low, both mining history and recent discoveries of very rich uranium deposits in Canada and elsewhere indicates that current estimates of uranium resources are minimum quantities. Thus, there is probably enough uranium for large-scale deployment of reactors fueled with low-enriched uranium on once-through cycles for many years, even without mining the large uranium in seawater resource base which is feasible at costs which imply electricity generation prices comparable to those for breeder reactors.

The evolution of nuclear power after World War II, including the development of the LWR and plans for early introduction of the breeder, was strongly influenced by the Cold War. In particular, the strong demand for uranium for nuclear weapons in the 1950s and 1960s and the operation of military reprocessing plants without adequate processing of waste streams led to the perception that uranium was scarce and reprocessing was cheap. In addition, the notion that reactor-grade plutonium could not be used to make reliable, light-weight nuclear weapons with yields greater than the bomb which destroyed Nagasaki became common in the nuclear industry. All these assumptions have now proven to be incorrect. If nuclear power is to be used on a large-scale, it must be transparently safe and not add to the risks of nuclear proliferation. Japan must lead in developing the required technologies and institutional frameworks as part of a broad energy strategy which gives "equal time" to renewable energy and "climate-friendly" uses of fossil fuels.

Ryo Ikegame
Executive Vice President
Tokyo Electric Power Co., Inc.

Keiji Kobayashi
Instructor
Research Reactor Institute
Kyoto University

[Memo]

Dialogue with the Public 18:00-20:00
on Nuclear Energy Development and Utilization

at Reception Hall, 4th floor, Bldg. 1, Nagoya Congress Center

Besides the conference participants, the public will be invited through mass media to attend this session.

During this session, an overview will be given of all questions and opinions received from the public on energy and nuclear power. Competent nuclear experts will be on hand to give brief responses to some of the more important questions. Individual questions will also be invited from the floor, with an exchange of opinions to follow.

[Memo]

[Memo]

Friday, April 19

Session 4 9:00-12:00 [Lectures]

"High-Level Waste Management--Promoting R&D and Consensus Building"

Nuclear power plays an important role in the supply of electricity and in environmental protection. However, management of high-level radioactive wastes (HLW) including its disposal is a critical task confronting all countries trying to promote nuclear power. Further assurances of public understanding will be secured if people learn about the safety of waste disposal. In that respect, such countries are prepared to make public the results of research on waste management and disposal, and to issue environmental impact statements (EISs). They also allow third parties to make and publicize their assessments, and to open the decision-making process of siting the facilities. Countries are now working much harder in this direction than they did when their existing nuclear installations were built.

In this session, experiences in France, Sweden, Switzerland, and the U.S. will be reviewed, with a discussion of how they should be evaluated and publicized. The achievements of Japanese R&D will also be explained. These efforts aim eventually to promote understanding and build a broader consensus among the public.

On Developing Public Consensus for Undergroud Laboratory for Disposal of High-level Waste in France

Maurice Allegre
Chairman, ANDRA
France

Building and Maintaining a Working Public Consensus: A Necessary Condition for Sustainable Progress in High-Level Waste Management in the United States

Susan Wiltshire, JK Research Associates, Inc.

During the late 1970s and early 1980s, there was a major effort in the United States to develop a national consensus about the management of spent fuel and high-level waste. A working consensus did develop that resulted in the passage of the Nuclear Waste Policy Act of 1982. However, there has been little subsequent effort to sustain that consensus.

This paper explores the need for maintaining a working consensus, discusses the difficulties in doing so, and suggests some means by which a working consensus might be achieved and maintained.

A working consensus is necessary for sustained progress in high-level radioactive waste management in the United States. The U. S. program for high-level waste management, established by federal law, is managed and regulated by several federal agencies. The program is subject to numerous legal requirements for review, comment, and involvement by other federal agencies, state and local governments, and the public and for extensive, external technical oversight. The program's funding is appropriated annually by the U.S. Congress, ensuring that the program will be reviewed by Congressional committees at least once a year. Nuclear electric utilities, which collect fees that fund the program and which are most affected by its progress, can make their opinions and influence felt through the political process, as

can other affected parties--states, tribes, public interest, environmental, anti-nuclear, and disarmament organizations, and the public. Since so many people and institutions are able to influence the conduct of the program, there must be a working consensus on the program's direction if the United States is to make sustained progress toward solutions.

A working consensus is difficult to achieve and maintain. Some characteristics of radioactive waste management make developing and maintaining a working consensus particularly difficult to achieve in the U.S. political system. These characteristics include the nature of the problem (highly technical, very controversial, involving radioactivity, concerning very long-time periods, faced with inevitable residual uncertainties); the nature of the process (long times between decisions, need for adaptive learning in an iterative process); and the inevitable changes in the political, economic, and social context that will occur over the life span of the program.

A consensus is most likely to be achieved and maintained if an effort to do so is carefully planned and implemented. The paper concludes with suggestions of approaches that can help build and maintain a working consensus about the direction and conduct of the high-level waste management program. It is important that these efforts allow for development and periodic reexamination of agreed upon goals, be as carefully planned as the technical program, take into account changes in society and in technical information, establish mechanisms for continuing two-way communication with external parties, and evidence respect for the points-of-view and responsibilities of all parties.

A phased strategy towards implementation of a Swiss high level waste repository

H. Issler
Nagra (National Cooperative for the Disposal of Radioactive Waste),

Abstract

For more than 15 years, Switzerland has been pursuing a phased strategy towards implementation of a deep geologic repository for high-level radioative wastes (HLW) and long-lived wastes (TRU). The modest quantities of spent fuel or HLW arising from a small nuclear power programme and the requirement for a long intermediate storage period to allow adequate heat decay together imply that a strategy extending over several decades is appropriate. It is, none the less, important for technical and public acceptance reasons that intermediate goals and milestones are established and worked towards.

The programme phases are in part delineated by the necessary technical steps in a geologic siting procedure: resulting in phases of regional surface exploration, localised surface exploration, full site characterisation and repository implementation. In part, however, the objectives of the phases are coupled to the requirement to increase in a stepwise fashion the confidence of the regulators and the public that an adequately safe repository system can indeed be implemented in Switzerland. This approach poses more subtle questions; since the most convincing demonstration of safety can be achieved only in the final phases of the programme, intermediate goals are required. These are of necessity less rigorous and to assess their fulfillment requires extensive use of human judgement.

The overall issue of disposal feasibility has been broken down in Switzerland into separate questions concerning constructability of deep facilities, siting possibilities and overall safety (especially long term). A phased programme requires that these questions be repeatedly posed and technically addressed in increasing depth as the programme advances. The current status of disposal planning is that all three topics are being addressed for two potential host rocks (crystalline rock and clay) at a technical level determined by the availability of localised data gathered by exploration from the surface at siting areas in both potential host rocks.

The paper addresses the technical issues involved and also covers the socio-political implications of communicating the above strategy to the scientific community, regulators and their experts, politicians and the public.

THE SWEDISH PROGRAMME FOR IMPLEMENTATION OF DEEP GEOLOGICAL DISPOSAL

Claes THEGERSTRÖM, Director of Deep Repository Division, Swedish Nuclear Fuel and Waste Management Company (SKB)

SUMMARY

The management of nuclear waste in Sweden is the responsibility of the producer, i.e. the nuclear power operators. They have jointly formed the Swedish Nuclear Fuel and Waste Management Company, SKB, to take on this responsibility.

SKB has a transportation system, a final repository for short-lived operational waste and an interim storage facility for long-lived spent nuclear fuel. What remains to be built is an encapsulation plant and a deep repository for final disposal of the fuel.

As a first step the strategy entails the implementation of deep disposal of a limited quantity (about 800 tonnes) of encapsulated spent nuclear fuel during the coming 20-year period. Following this initial deposition, the results of the work will be evaluated, and only then will a decision be taken as to how and when regular deposition of the main body of the fuel and other long-lived nuclear waste will take place.

At the end of 1992, SKB focused and intensified its work on the planning, design and siting of a plant for encapsulation of spent nuclear fuel and of a deep repository.

It has been proposed that the encapsulation plant be situated at the central interim storage facility for spent nuclear fuel, CLAB, at the Oskarshamn Nuclear Power Station. First a testing plant för sealing and non-destructive testing of canisters will be set up. Siting for the deep repository will take place in stages, and the work has been commenced with feasibility studies. These feasibility studies, which are planned for five to ten municipalities, are taking more time than was predicted in 1992. After the feasibility studies, geoscientific site investigations of two sites are planned. After this, one site will be selected for detailed characterization with shaft/tunnels to repository depth.

SKB's ambition is to carry out siting and construction of the required facilities in consensus with the concerned municipalities and local populations. The work of carrying out an environmental impact assessment (EIA) in an open and broad process occupies a central role in this context. At present feasibility studies have been made in two municipalities and are under way in two other.

The Äspö Hard Rock Laboratory (HRL) is a central resource for continued development and research on barrier functions, measurement methods and work methods. A comprehensive programme with verifying tests has been initiated and will continue during the coming years.

Nine foreign organizations from eight countries including Japan, are participating in the work at the Äspö HRL under bilateral agreements.

In addition to the technical and safety-related aspects, it is important to continue to develop the forms for communication of knowledge and facts on nuclear waste management in society. SKB will devote considerable efforts to the implementation of the EIA process in conjunction with siting and construction of both the encapsulation plant and the deep repository.

Strategies for Geological Disposal of High-level Radioactive Wastes --Overseas Experiences and Japan's Programme

Atsuyuki Suzuki
Professor of Nuclear Engineering
University of Tokyo

The disposal of high-level waste (HLW) is a social issue rather than a technical one. This is clear from the situation in many countries over this issue.

In France, under the agreement at the Parliament level, underground research laboratories (URL) are first to be built at a couple of places. Based on the study results, the country will select the actual repository site from among those URL sites. In the United States, it was decided to construct a repository facility at Yucca Mountain, Nevada, mainly for the political reasons. The final decision will be made after a so-called "site characterization," which examines the suitability as a repository site. For various but mainly social reasons, however, the plan lags far behind the original schedule. In Sweden, technical development has been promoted in connection with granite since earlier days, because it has relatively uniform geological features. The country is now ready to select the location. Switzerland is pursuing technical development, principally on granite, and is in the similar situation to Sweden. However, Switzerland is also doing research on sedimentary rocks to complement the granite study.

In consideration of these overseas experiences, Japan seems to be groping for its own course. The social difficulty surrounding the disposal of radioactive wastes is as hard as in any other nation. Japan has built a burial facility in Rokkasho village, Aomori Prefecture, to dispose of low-level radioactive waste produced in nuclear power plants. The country, however, has not implemented a plan for disposing of so-called RI wastes (radioisotope contaminated wastes) from medical institutions and research institutes. Only a few countries has failed to deal with RI waste disposal, which causes practically no concerns in terms of radioactivity. As for the technical development of HLW disposal facilities, Japan has difficulty even in making boring surveys to obtain basic data on disposal. It is needless to say that locating underground research facilities is still more difficult in Japan. There is virtually no nation in the world that has difficulty in making basic boring surveys.

Under such situation, it is quite significant that an agreement was reached at the end of last year to establish a scientific research institute in deep underground, between the cities in Gifu Prefecture, Mizunami and Toki, and the Power Reactor and Nuclear Fuel Development Corporation (PNC). This institute, however, should not be directly related to technical development of HLW disposal facility. It is peculiar to Japan to attach such collateral condition.

Unlike Sweden, the geological features in Japan are not uniform. Therefore, it is rather difficult to specify the nature of the geological formation beforehand. Furthermore, it is not easy to look for the places where no underground water exists, just like Yucca Mountain in the United States. Having the difficulty in actually collecting specific underground data, in spite of Japan's geo-environmental characteristics: relatively diversified geological features and apparent existence of underground water, Japan has adopted a policy to design and build an underground disposal system which will respond to the diversified geological environment. Japan pays attention to the fact that the potential subterranean repository space has inherent physical or chemical property, in spite of the diversity of geological environment, and has taken an approach to ensure the environmental safety of underground water by precisely investigating the safety performance of the repository site itself and the surrounding disposal space. The effectiveness of this approach has been pointed out in Swedish and Swiss reports of the performance assessment studies.

Since the disposal is a social issue, it is difficult to solve it only by technological endeavors. To overcome the social difficulty, however, it is essential to fully ensure technical reliability. One of the most important things to Japanese (geological disposal) programme is to enhance the efforts to show the technical reliability, especially the social efforts necessary for doing so.

SESSION 5 14:00-17:00 [Panel discussion]

"Nuclear Non-proliferation and Plutonium"

Last May's decision to extend the Nuclear Non-Proliferation Treaty (NPT) indefinitely was not reached unconditionally, highlighting the gap between those interests of nuclear and non-nuclear member states. After 25 years of the nuclear monopoly by five nuclear states, the NPT is now faced with challenges in the dynamic post-Cold War world. The requirements are heightened of the international society to limit nuclear weapons with efforts by nuclear parties with respect to the article 6 of the treaty.

The Comprehensive Nuclear Test Ban Treaty (CTBT) should meet a conclusion by the end of 1996 and negotiations for the cut-off production of fissile materials must start at an early date. While, in support of the NPT regime, some positive moves have been made as demonstrated by South Africa's renouncement of nuclear weapons program, there are arguments in some corners about the potential of the plutonium use as this could generate the proliferation of nuclear weapons. It is of crucial importance to deal with those for the future NPT regime.

This session aims to provide a rationale for the peaceful uses of plutonium and discuss the measures to reinforce the nuclear non-proliferation regime.

Plutonium and Proliferation: A 1996 Personal View

Richard L. Garwin

The highest priority of civil nuclear power, the safety of the public, would be at risk if nuclear weapons were to proliferate to sub-national groups or to terrorist nations by theft or sale of separated fissile material, by acquisition of spent fuel and separation of Pu from it, or by the open or clandestine misuse of enrichment facilities to produce weapon-usable uranium containing more than 20% U-235 (90% is typical). The massive ongoing reduction in nuclear US and Russian nuclear weaponry will involve the removal from warheads of at least 50 tons of weapon Pu on each side by the year 2003. In January 1994 a report from the National Academy of Sciences indentified this separated weapon Pu (and a larger amount of high-enriched uranium) as a "clear and present danger" and called for urgent action to provide safe, secure interim storage for the separated weapon-usable material and to begin its conversion to a form that would be no more available than spent fuel from power reactors--the "spent-fuel standard"; it called for urgent implementation BOTH of a U.S. program to burn this excess W-Pu in reactors of existing type AND a program to begin to vitrify the W-Pu together with high-level fission product waste. A 1995 report from an international panel of the American Nuclear Society endorsed the "clear and present danger" and the "spent-fuel standard"; it urged likewise the burning of the separated W-Pu in reactors of existing types and noted that next-generation reactors could also be useful. The ANS report agreed that Pu separated from normal power reactor spent fuel could also be used in nuclear weapons. The ANS report went beyond the NAS report in emphasizing the proliferation hazard of spent nuclear fuel itself, concluding that there is no need for fuel cycle uniformity among nations--both stow-away and reprocessing options being appropriate IF they are conducted in a safe and proliferation-resistant fashion. ANS urged that nations choosing the once-through (also known as "stow-away") option move the spent fuel through safe and secure storage into a repository expeditiously. However, neither the U.S. nor Russia has accomplished much in the two years since the CISAC report, either in "transparency" or in choice of actual modes of disposition. This paper provides some personal recommendations for action, by the U.S., by Russia, and by the interantional community.

Richar Butler
Ambassador to the United Nations
Australia

Abstract by Dr. Ryukichi Imai

1. That plutonium is a complicated issue needs not be repeated. The problem has become more complex with the end of the cold war and end of the nuclear confrontation between the East and West.

2. It is likely that the nuclear weapon states would cease to produce any additional weapons grade plutonium, although one is not sure about possible Chinese position in this regard. Plutonium production in other states such as India and Israel has to be re-examined under the new light.

3. START-II treaty, although not yet ratified and it may be possible that the treaty will become effective in a manner similar to the way in which SALT-II was unratified but observed, will reduce the numbers of nuclear warheads in US and Russia in a drastic manner (it is reported that the two countries have capabilities to safely dismantle and store the plutonium core up to two thousand a year).

4. US National Academy of Science panel, and American Nuclear Society panel, independently came to the conclusion that the best way to dispose such weapons grade plutonium is to burn it in reactor and thus change isotopic compositions. It is also reported that the rapidly increasing world energy demand would make use of plutonium necessary. This is because of limited resources of oil, gas and economically recoverable uranium, while extensive use of coal (unless new clean coal technology is developed) will increase atmospheric CO2 concentration in the 21st century to well over 500 ppm.

5. Technology for efficient burning of plutonium is not yet around the corner. Pu burning in LWR as mixed oxide (MOX) fuel has already been technically well established. The extent to which this will be put in practice will depend upon specific fuel cycle economy calculations, MOX fuel fabrication cost being one of the major factors.

6. There are, of course, larger tonnage of reactor-grade plutonium to be extracted from spent LWR fuel. Specific economics will again depend on specific fuel cycle, including the cost to the public of transporting and storing either spent fuel or extracted plutonium. Technology for reactors (either fast or thermal ?) optimized for plutonium fuel is yet to be realized.

7. One very important problem is that IAEA safeguards based on the current material control and significant quantity will be inadequate to take care of the increasing volume of the world's plutonium. For one thing, some kind of international material control and verification measures will have to be extended to cover the nuclear weapon states. Much may depend on how CTBT and cut-off agreements may be shaped.

8. It is a matter for urgent considerations that a group of like-mined countries with relevant technical and financial capabilities should initiate consultation for establishment of the new and updated means for international safeguards on plutonium.

Joaquin Mercado
Director General for the United Nations Affairs
Ministry of Foregin Affairs
Mexico

Non-Proliferation and CTBT

Fudan University: Mingquan Zhu

Abstract

China advocates prevention of the proliferation of nuclear weapons as part of the process of eliminating such weapons. In May 1995, at the Conference on the Review and Extension of the Treaty on the Non-Proliferation of Nuclear Weapons, China supported the decision to indefinitely extend the treaty.

According to China, only extending the NPT is not enough. In order to make mankind ultimately ridding of the threat of nuclear war and achieve the goal of a world without nuclear weapons, it should be used cooperatively with other measures. They should make up an integrated and inter-related nuclear disarmament process. Both nuclear weapons states and non-nuclear weapons states have their rights to participate in the process. Other measures include. Sign a No First Use Treaty by nuclear weapons states; conclude a treaty on CTBT at latest in 1996; promote nuclear disarmament.

It is totally for self-defense that China owns a few of nuclear weapons and make a few of nuclear tests. From the first day it gained nuclear weapons, China has solemnly undertaken not to be the first to use nuclear weapons at any time and in any circumstances and unconditionally not to use or threaten to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones. This unconditional provision of "negative security assurance" to all non-nuclear-weapon states was reiterated on April 5, 1995 in an official statement by China. At the same time, it undertook to provide these nations with "positive security assurance". Namely, when any non-nuclear-weapon state is attacked with nuclear weapons, China will take actions in the Security Council of UN so that it can take adequate measures to assist the victimized country and apply sanctions against the aggressor country.

Therefore, any non-nuclear-weapon state which understands China's policy very well has no cause to worry over China's nuclear tests which are very limited in numbers. Moreover, Chinese government has declared that it will stop nuclear tests as soon as the CTBT is put in force. In fact, China's position on international arms control and disarmament can greatly promote non-proliferation.

[Memo]

Brief Biography of Chairmen, Speakers, and Panelists

Member List of the Program Committee for the 29th JAIF Annual Conference
(In Alphabetical Order)

Chairman: Tsuneo IIDA
Professor of Economics
International Research Center for Japanese Studies

Members: Toshiko ABURADA
Executive Director
Association of Advocators for Consumers Everyday-life

Hiroaki FUKAMI
Professor, Keio University

Reinosuke HARA
Senior Advisor, Seiko Instruments Inc.

Koichi HASUMI
Executive Vice President & Director, Chubu Electric Co., Inc.

Ryo IKEGAME
Executive Vice-President, Tokyo Electric Power Co., Inc.

Ryukichi IMAI
Professor, Kyorin University

Noboru KUROYANAGI
Senior Managing Director, Federation of Electric Power Companies

Hiroyuki MINOURA
Manager of Economic Dept., Chunichi Shimbun

Michiko MIYAMOTO
Professor, Chiba University

Yasuo NAGAI
Executive Vice President, Mitsubishi Heavy Industries, Ltd.
Chairman, Nuclear Energy Policy Planning Committee
Japan Electrical Manufacturers Association

Kojiro NISHINA
Professor, Nagoya University

Hiroshi OHISHI
President, Power Reactor and Nuclear Fuel Development Corporation

Takuo SATO
General Manager of News Dept., Tokai Television Broadcasting Co., Ltd.

Yoshihiko SUMI
Director & Executive Vice-President, Kansai Electric Power Co., Inc.

Shuzaburo TAKEDA
Professor, Tokai University

Genki YAGAWA
Professor, University of Tokyo

Teiichi YAMAMOTO
Managing Director, Kawasaki Steel Corporation

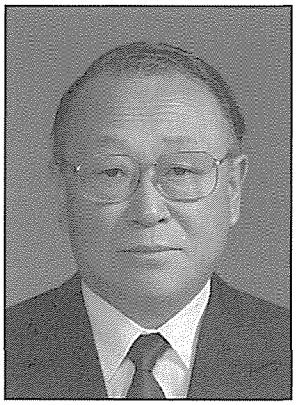
Hiromichi YOKOYAMA
Chief Editor of Science News Dept., Mainichi Newspapers

Observers: Teruyoshi INAGAWA
Deputy Director-General for Arms Control and Scientific Affairs
Ministry of Foreign Affairs

Toru NAMIKI
Deputy Director-General, Agency of Natural Resources and Energy
Ministry of International Trade and Industry

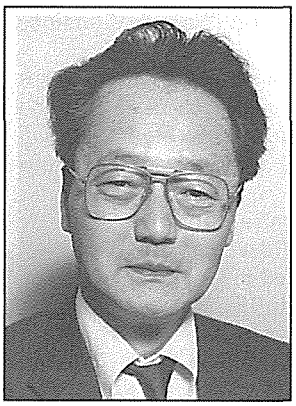
Naotaka OKI
Deputy Director General, Science and Technology Agency

OPENING SESSION



Hiroji Ota

Date of Birth: November 29, 1932
Education:
1955 Graduated from the Faculty of Engineering, Tokyo University
1995 Received a doctor's degree in engineering from Nagoya University
Occupational experience:
1955 Chubu Electric Power Co., Inc.
1972 Manager, Facility Operations Dept.
1974 Manager, Corporate Planning Dept.
1978 Deputy General Manager, Corporate Planning Dept.
1981 General Manager, Corporate Planning Dept.
1982 Senior General Manager, Corporate Planning Dept.
1983 Senior General Manager, Information and Public Affairs Dept.
1985 Director & General Manager of Tokyo Office
1989 Managing Director & General Manager of Corporate Planning Dept.
1991 Executive Vice President & Director and General Manager of Research & Development Bureau
1993 Executive Vice President & Director
1995 President & Director



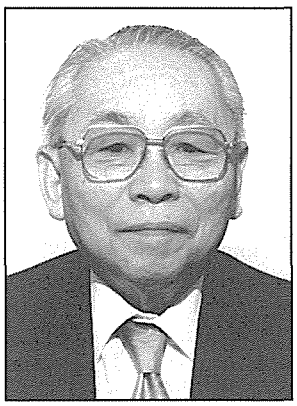
Tsuneo Iida

Born on September 27, 1932
Education: Graduated from the faculty of economics, Nagoya University, March 1955.
Finished the postgraduate school of economics, Nagoya University, March 1960.
Received Ph.D. in economics from Nagoya University, September 1963.

Occupation: Associate professor of economics, Nagoya University, July 1964.
Professor of economics, Nagoya University, January 1976.
Dean, Faculty of Economics, Nagoya University, 1987-88.
Professor of Economics, International Research Center for Japanese Studies, April1989.

Overseas Experience etc. : Advisor at BAPPENAS (National Economic Planning Board), Government of Indonesia, 1972-73.
Japan Foundation Professor at the Centre of Japanese Studies, Sheffield University, 1980.

Main Publications:
"A Non-neoclasssical Analysis of Resource Alloccasion in the Dual Economy" Economic Journal, Sept. 1965.
"The Lineage of Japanese Economics," Japanese Economic Studies, Summer 1976.
"Evaluation of the Policymakers," Japanese Economic Studies, Fall 1977.
"What is Unique about the Japanese Economy?" Oriental Economist, July 1981.
Blind Partners: American and Japanese Responce to an Unknown Future, 1985.

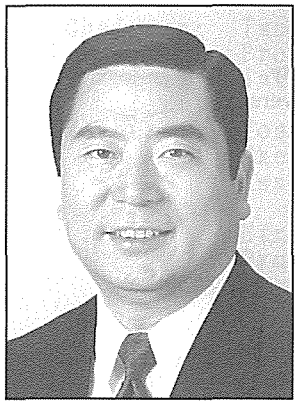


Takashi Mukaibo

Date of Birth : March 24, 1917
1939 B. S. in Engineering, the University of Tokyo
1947-54, 1958-59 Associate Professor of the University of Tokyo
1954 Ph. D. in electrochemistry, at the University of Tokyo
1954-58 Science Attaché, Embassy of Japan in USA
1959-77 Professor of the University of Tokyo
1968-69 Dean, the Faculty of Engineering, the University of Tokyo
1977-81 President, the University of Tokyo
1981-91 Acting Chairman, Japan Atomic Energy Commission
1992- Chairman, Japan Atomic Industrial Forum, Inc.

1983- President, Japan Association of Engineering Education
1985- President, Japan Society for Science Policy and Research Management
1989- President, Engineering Academy of Japan

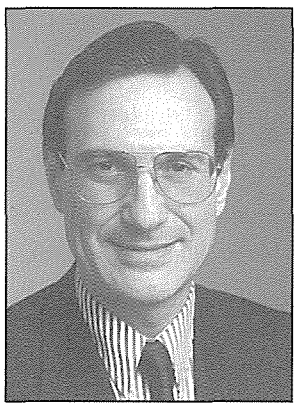
Awards:Order of Gorkha Dakshin Bahu, First Class, His Majesty a Government of Nepal (1977); Commondatore Al Merito Bella Republic Italiana (1980); Ordem Nacional do Cruzeiro do Sul, Brasil (1982); the Henry de Wolf Smyth Nuclear Statesman Award, American Nuclear Society and American Atomic Industrial Forum (1984); Ordem de rio Branco (Grande Official), Brasil (1988); the First Class Order of the Sacred Treasure (1989), etc.



Hidenao Nakagawa

Date of birth:February 2, 1944

1966	Graduated from Faculty of Law of Keio University.
1966-73	Worked at The Nikkei Shimbun (Newspaper)
1976	First elected Member of the House of Representatives
1983-84	Vice Minister for National Land
1986-87	Vice Minister for International Trade and Industry
1988-89	Chairman, Committee on Science and Technology, the House of Representatives
1989-90	Chairman, Commerce and Industry Committee of the Liberal Democratic Party
1994-96	Deputy Secretary General, the Liberal Democratic Party
1996	Minister of State for Science and Technology; Chairman of Atomic Energy Commission; Chairman of Space Activities Commission



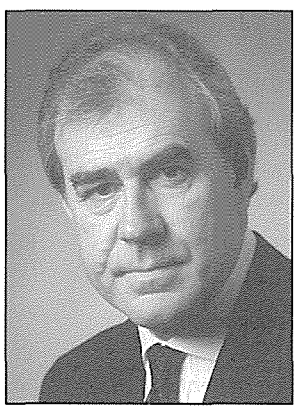
Yannick d'Escatha

Mr. d'Escatha was appointed Administrator General of Commissariat à l'Energie Atomique (French Atomic Energy Commission) on July 1, 1995.

Mr. d'Escatha, who is 48, is a graduate of Ecole Polytechnique (1966) and Ingénieur au Corps des Mines. In 1972, he was appointed Professor at Ecole Polytechnique and Ecole des Mines and ENSTA (1971-77). His works and research at the Mechanics Laboratory of Ecole Polytechnique have made him a leading specialist in Fracture Mechanics. Mr. d'Escatha's publications gave him an Academy of Sciences Award in 1982.

He joined the Nuclear Industry when appointed Head of the Control Office for Nuclear Construction where he was in charge of State Technical Control (1978-81).

In 1982 he joined TECHNICATOME, a subsidiary of CEA, specialized in Nuclear Propulsion and became Director for the Cadarache and Aix en Provence plants. In 1987, he was appointed Deputy Director General of TECHNICATOME. In 1990-92, he was appointed Director of Advanced Technologies, a newly created Department within CEA.



Richard Butler

Richard Butler took up appointment as Australian Ambassador and Permanent Representative to the United Nations in March 1992.

He was born in New South Wales, Australia, in 1942. He holds degrees from the University of Sydney and the Australian National University.

In 1983 he was appointed Australia's first Ambassador for Disarmament. In that role he led the Australian Delegation to the Conference on Disarmament in Geneva and was charged with conducting all Australian disarmament negotiations, both in United Nations institutions and, directly, with individual countries.

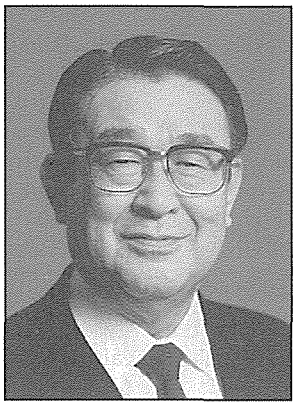
In 1989 he was oppointed Australian Ambassador to Thailand and, simultaneously in 1991, Ambassador and Permanet Representative of Australia to the Supreme National Council of Cambodia.

In 1992 the General Assembly of the United Nations elected him Chairman of the United Nations Preparatory Committee for the Fiftieth Anniversary of the United Nations, in 1995.

In 1994 he was elected President of the Economic and Social Council of the United Nations.

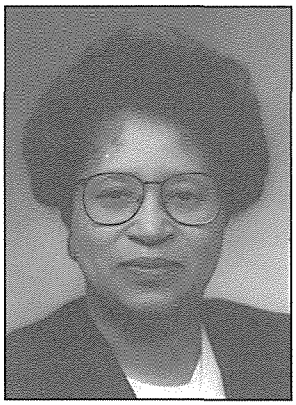
In September 1995, he was made a Fellow of the Foreign Policy Association, New York.

In November, 1995 the Prime Minister of Australia appointed him Governor of the Canberra Commission on the Elimination of Nuclear Weapons.



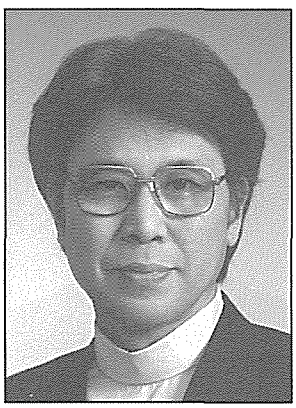
Takeshi Nagano

Takeshi Nagano is Director and Counselor of Mitsubishi Materials Corporation. In September 1945, he graduated from Tokyo University (Mine and Metallurgy Course of the No.1 Engineering Department). He obtained a Ph.D. degree in pyrometallurgy in 1962.
In 1945, he joined former Mitsubishi Metal Corporation.
From 1963-67, he worked for Onahama Smelting and Refining Co., Ltd. In 1969, he became General Manager of the Metallurgy Department, Mitsubishi Metal Corporation. In 1970, he was named General Manager of Naoshima Copper Smelter, being elected Director of Mitsubishi Metal Corporation in 1971, Managing Director in 1973, and Senior Managing Director in 1977. He was promoted to Executive Vice President in 1981, and the following year became President of Mitsubishi Metal Corporation. In December 1990, he was elected Chairman of Mitsubishi Materials Corporation (a merged company with Mitsubishi Metal Corporation and Mitsubishi Mining and Cement Co., Ltd.). In June 1995, he became Director and Counselor of the Company.
From 1985-86, he served as President of Japan Mining Industry Association, and Chairman of Mining and Materials Processing Institute of Japan since 1987-88. From April 1989 to April 1991, he served as Vice Chairman of KEIZAI DOYUKAI (Japan Association of Corporate Executives). In May 1991, he was elected Chairman of NIKKEIREN. In May 1995, he became Senior Adviser and Chairman of Senior Advisers Council of NIKKEIREN.
In November 1984, he was given a Medal with Blue Ribbon by His Imperial Majesty, Hirohito. In September 1988, he was presented a 1988 World Material Congress Award from ASM International. In November 1994, he was given the Grand Cordon of the Order of the Sacred Treasure by His Imperial Majesty, Akihito.
Born on March 17, 1923.



Shirley A. Jackson

Shirley A. Jackson is a theoretical physicist. She was sworn in as an NRC Commissioner on May 2, 1995 and assumed the Chairmanship two months later, on July 1. Prior to joining the NRC, she had extensive experience as a.university professor, research scientist, consultant and corporate director.
Matriculating at M.I.T. she earned a Bachelor of Science degree in physics in 1968 and a Ph. D. in the field of theoretical elementary particle physics in 1973.
From 1991 to 1995, Dr. Jackson was a Professor of Physics at Rutgers University in ,Piscataway, N.J. , serving concurrently as a consultant in semiconductor theory to AT&T Bell Laboratories in Murray Hill, N.J.
She has served on the board of directors of Public Service Enterprise Group and its subsidiary, Public Service Electric and Gas Company, Sealed Air Corporation, CoreStates Financial Corporation, CoreStates New Jersey National Bank, and New Jersey Resources Corporation. She is a Life Member of the M.I.T. Board of Trustees. She has served on an advisory panel to the Secretary of Energy on the future of Department of Energy national laboratories, served on research councils of the National Academy of Sciences and on the Advisory Council of the Institute of Nuclear Power Operations (INPO). Dr. Jackson has also served on a number of high level commissions in the state of New Jersey.
Dr. Jackson has achieved a number of firsts in her career. She was the first African-American woman to receive a doctorate from M. I.T.; she was the first African-American to become a Commissioner of the NRC; she was the first woman and the first African-American to serve as Chairman of the Commission.

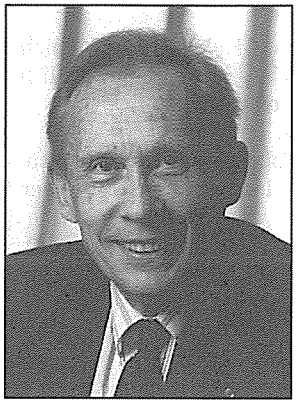


Yoichiro Murakami

Born in Tokyo in 1936.
Graduated from University of Tokyo at the Department of History and Philosophy of Science in 1962.
Finished the Doctoral Programme at the same University in 1968.
Started his career at Sophia University. After appointed as associate professor, full professor at Univeristy of Tokyo, and the director at the Research Center for Advanced Science and Technology of the same university, now full professor at the International Christian University.
A member of the Pontifical Academy of Social Science. Vice-chair for CSTP of OECD.
Research Areas: history of science and technology, sociology of ST, and ST Studies.
Author of over 25 single-authored books of related areas and 150 papers in academic journals.

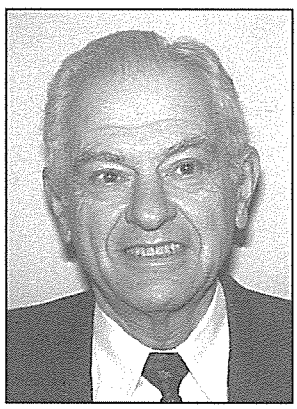
R. Chidambaram

Born 12 November 1936; Madras, Tamil Nadu
Ph.D. (1962), D.Sc. (1991), Indian Institute of Science, Bangalore; D.Sc. (h.c.) (1993), Andhraa University, Waltair
Research Achievements:
Chidambaram initiated research in high-pressure physics in Bhabha Atomic Research Centre (BARC) and established a group in this field with a strong theoretical background and experimental facilities - a group regarded as the best in the country and one of the best in the world. Also initiated neutron crystallography research in BARC and the work of this group is internationally recognized. Has made important contributions to the nuclear energy programme, including the nuclear experiment at Pokhran in 1974.
Positions:
Chairman, Atomic Energy Commission and Secretary, Department of Atomic Energy;
Hony Professor, Jawaharlal Nehru. Centre for Advanced Scientific Research, Bangalore;
Director, Bhabha Atomic Research Centre, Bombay.
Learned and Professional Societies:
Fellow, Indian Academy of Sciences (sometime Vice-President) ; Hony Fellow, Indian Institute of Materials Management; Vice-President, Materials Research Society of India (1993) ; Member, INSA Council (1988-90).



Rémy Carle

Rémy CARLE was born in 1930. He is an engineer graduate from Ecole POLYTECHNIQUE (1951) and from Ecole des MINES de Paris (1954).
He joined the French Atomic Energy Commission in 1956 where is major field of activities was the construction of industrial reactors. As head or the Department of Reactors construction, as Director of the Reactors Division and at last as President of Technicatome, he was directly in charge of the management and the direction of major reactors project: the heavy water moderated, CO_2 cooled reactor EL4 (80 el MW) the fast neutron breeder reactor Phenix (250 el MW) and the preparation of the Superphenix breeder reactor (1200 el MW).
In 1976 he joined the French national utility Electricite de France at the Direction Staff as Head of Generation Division, then Director of the Construction Division. Since 1987 he is Deputy General Director, directly in charge of all the nuclear activities.
He founded the French Nuclear Energy Society in 1976 and was twice President of this Society.
Since April 1993, he is Chairman of the World Association of Nuclear Operators. (WANO)
He is also President of Nucnet, a worldwide nuclear news agency.

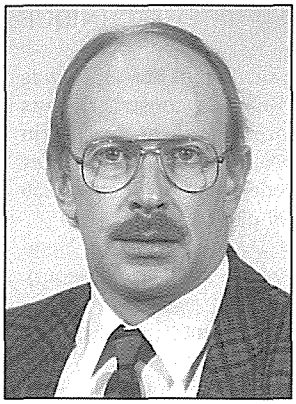


Morris Rosen

Morris Rosen is Deputy Director General of the Department of Nuclear Safety, of the International Atomic Energy Agency(IAEA). He joined the Vienna Secretariat in 1974 after a one-year assignment in Korea. Prior to joining IAEA, Dr. Rosen was head of the accident analysis branch and later technical assistant to the director of regulations at the U.S. Atomic Energy Commission. He was formerly with Combustion Engineering and the General Electric Corporation. Dr.Rosen holds both a bachelor's and a master's degree in chemical engineering. He received his Ph.D. from Rensselaer Polytechnic Institute.

Itsuzo Shigematsu

Date of Birth : November 25 1917
Educational history:
1941 Graduated from Faculty of Medicine, the University of Tokyo (M. D.)
1952 Conferred degree of Doctor of Medical Sciences (Dr. Med, Sci.)
1955 Conferred degree of Master of Public Health (M. P. H.) from Harvard School of Public Health
1992 Fellow of the Royal College of Physicians of London (FRCP)
Occupational history:
1942-46 Research Associate, Department of Internal Medicine, University of TokyoHospital, Tokyo
1947-61 Researcher and Chief, Division of Chronic Infectious diseases, Department of Epidemiology, Institute of Public Health (IPH), Tokyo
1962-66 Professor of Public Health, Kanazawa University School of Medicine, Kanazawa
1966-81 Director, Department of Epidemiology, IPH
1981- Chairman, Radiation Effects Research Foundation, Hiroshima, and Professor Emeritus, Institute of Public Health, Tokyo
1984- Visiting Professor of Public Health, Showa University School of Medicine, Tokyo
Major activities : Member, Expert Advisory Panel of World Health Organization (WHO); Member, Group to Review Nuclear War and Health Consequences, WHO ; Member, Senior Committee on Environment and Health, WHO ; Member, International Commission on Radiological Protection (ICRP); Chairman, International Advisory Committee of the Chernobyl Project, International Atomic Energy Agency (IAEA); Chairman, Radiation Council, Prime Minister's Secretariat ; Chairman, Research Committee on A - bomb Health Effects, Ministry of Health and Welfare ; President, Hiroshima International Council for Health Care of the Radiation-Exposed (HICARE)



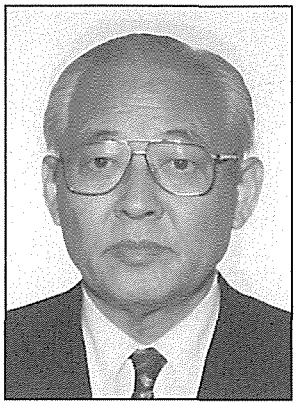
Anselm Schaefer

Born on October 9, 1946, in Bad Nauheim, FRG
Education: classical high school, studies in physics at the universities of Heldelberg, Munich and Strasbourg, diplomas in experimental physics from Technical University Munich (1972) and in theoretical physics from Université Louis Pasteur in Strasbourg (1972)

Professional activities and publications in material science, reactor physics, thermal-hydraulics, numerical simulation techniques, simulation computer code development, nuclear power plant accident analysis, and nuclear safety concepts and strategies.

Worked from 1975 until 1976 as a researcher at the Technical University Munich; since 1977 for Gesellschaft für Anlagen und Reaktorsicherheit (GRS) as nuclear power plant simulation software developer, head of nuclear plant safety analysis group, and (currently) scientific adviser of the managing director; lectures at the Technical University Munich.

SESSION2



Kunihiko Uematsu

Date of birth: May 4, 1931
Place of birth: Kagawa, Japan
Careers :

1954 Graduated from Kyoto Univ.
1956 Master of Science from Kyoto Univ.
1961 Doctor of Philosophy from M.I.T.
1961 Lecturer of Kyoto Univ.
1964 Joined Atomic Fuel Corporation.
(Reorganized to PNC in 1967)
1968 Senior Research Engineer.
FBR Project, PNC (Power Reactor and Nuclear Fuel Development Corporation)
1982 Director of Fuels Development Division, PNC
1983 Executive Director, PNC
1988 Director General , OECD/NEA
1995 Technical Advisor, PNC

Yuanquan Zhou

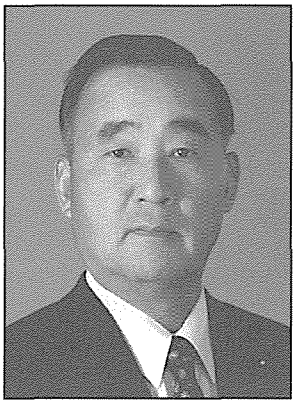
Born on August 20, 1935

1960 Graduated from Moscow Institute of Mining and Metallurgy
1960-63 Nuclear Industry Corp.
1963-70 Nuclear Industry Research and Design Insititute
1970-84 Nuclear Power Dept., Nuclear Ministry
1984-88 Deputy Director, Dept. of Science and Technology, Nuclear Ministry
1988-92 Director, Bureau of Science and Technology, CNNC
1992-93 Director, Bureau of Multiple Operations, CNNC
1993- Director, Bureau of International Cooperation, CNNC
President, China Nuclear Energy Industry Corporation

Adiwardojo

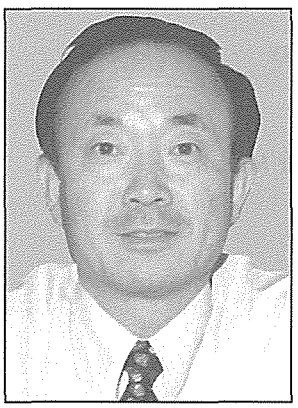
Place and date of birth: Surakarta, Indonesia, 15 March 1952
Education:
Graduated in 1978 as Mechanical Engineer from the University of Gajah Mada in Yogyakarta, Indonesia.
Experiences:
Since 1976 working for the National Atomic Energy Agency (BATAN) of Indonesia.

1976 Mechanical Division Staff of BATAN in Yogyakarta, Indonesia.
1978 Research Staff of BATAN, Yogyakarta, Indonesia.
1981 Head of the Electromechanical Workshop Installation in BANTAN, Yogyakarta, Indonesia.
1984 Head of the Electromechanical Division for the Nuclear Industrial Research and Development Center in Jakarta, Indonesia.
1986 Manager of Engineering and Design for the Nuclear Installation Management Unit in Serpong, West Java, Indonesia.
1992 Director for Nuclear Energy Studies.



Yoshihiko Sumi

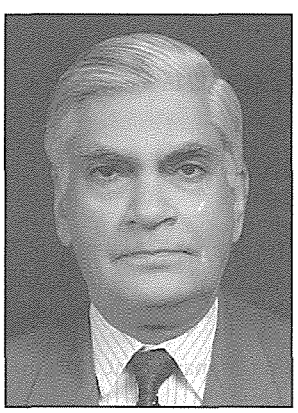
Date of Birth: November 15, 1930
Academic Career:
1953 Graduated from Electrical Engineering, Kyoto University
Professional Career:
1953 Joined the Kansai Electric Power Co., Inc.
1971 Director of Kujyo Sales office
1972 Resident Engineer in Indonesia as a member of Newjec Inc.
1974 Assistant General Manager, System Engineering Department
1977 General Manager, System Engineering Department
1979 General Manager, Central Office of High Voltage Transmission Projects Construction
1981 General Manager, Hokuriku District Office
1983 General Manager, Fukui Nuclear Power District Office
1985 Elected to the Member of the Board of Directors
General Manager, Fukui Nuclear Power District Office
1986 Board Director, Nuclear Operations
1987 Board Director, Nuclear Operations and Nuclear Projects
1988 Managing Director
1991 Senior Managing Director
1993 Director and Executive Vice-President



Joo-Bo Hong

General Manager, Nuclear Power Generation Dept. KEPCO

Date of birth: September 20, 1940
1964 Graduated from Hanyang University with B.A Degree In Mechanical Engineering and entered KEPCO
1992-94 Director, Ulchin Nuclear Power Division
1994 Director, Wolsong Nuclear Power Divison
1994- General Manager, Nuclear Power Generation Dept.

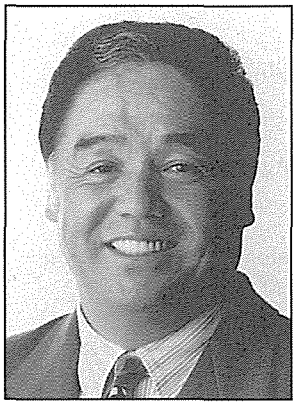


Ishfaq Ahmad

Date and place of birth: November 3, 1930 in Gurdaspur, Pakistan
Occupation: Chairman, Pakistan Atomic Energy Commission (PAEC)
Education:1949-51 Master of Science from University of Punjab, Lahore (Pakistan)
1954-58 Doctor of Science from University of Montreal, Canada
Career:1952-60 Lecturer, Government College, Lahore
1960-66 Senior Scientific Officer, PAEC
1967-69 Secretary, PAEC
1969-71 Director, Atomic Energy Centre, Lahore
1971-76 Director, Pakistan Institute of Nuclear Science and Technology, PAEC
1976-88 Member (Technical), PAEC
1988-91 Senior Member, PAEC
1991- Chairman, PAEC

He is currently serving on the Executive Committee of National Commission for Science and Technology which is the apex body for S&T policy and programmes in the country. He is also on the Board of Governors of Pakistan Science Foundation, National Institute of Electronics and several other scientific and educational institutions in Pakistan. He was elected Fellow of the Pakistan Academy of Sciences in 1983 and decorated with Sitara-i Imtiaz in 1990. His scientific interests cover several areas of theoretical and experimental nuclear physics, and has a large number of research papers to credit.

LUNCHEON



Kazutaka Tsuboi

Date of birth:July 15, 1939

1962 Graduated from Kansai University (Faculty of Law)
1975 First elected to the Assembly of Osaka Prefecture
Vice Chairman, Standing Committee on Commerce, Industry, Agriculture and Forestry, Osaka Prefectural Assembly
1979 Chairman, Tsurumi Ward Branch of Party Federation, Liberal Democratic Party (LDP)
1984 Secretary-General, Osaka Prefectural Assembly Members of LDP
1985 Chairman, Osaka Prefectural Assembly
Vice Chairman, Osaka Prefectural Federation of Party Branches, LDP
1986 Chairman, General Council, Osaka Prefectural Federation of Party Branches, LDP
1987 First elected to the House of Councilors
Member, Standing Committee on Finance, House of Councilors
1988 Chairman, Policy Research Council, Osaka Prefectural Federation of Party Branches, LDP
1992 Members, Standing Committee on Labor, House of Councilors
1993 Director, Special Committee on Okinawa and the Northern Territories, House of Councilors
1994 Chairman, Special Committee on Okinawa and the Northern Territories, House of Councilors
1995 Director, Standing Committee on Labor, House of Councilors
Vice Secretary-General, LDP
1996 Parliamentary Vice-Minister of International Trade and Industry

Michiko Imai

Born on February 1, 1942 in Tokyo.

Dr. Imai, a well-known woman mountain climber, is now a lecturer at Department of Urology, Kidney Center, Tokyo Women's Medical College.

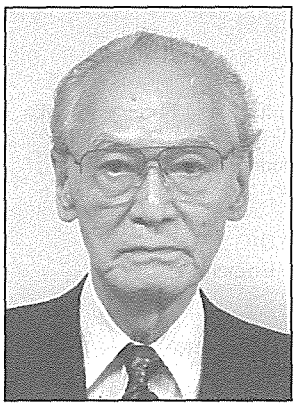
In 1966, she graduated from Tokyo Women's Medical College, where she joined the mountaineering association of the College in 1960.

She was the leader of the first women party to have achieved climbing the Northern Cliff of Mt. Matterhorn in European Alps in 1967, and two years later, she also climbed the Northern Cliff of Mt. Eiger. In 1979, she successfully led a party in climbing the Himalayan Dhaulagiri Mountains II, III and V.

Currently, she serves as a member of Committee for Environment Protection of the Environment Agency, Committee for Consumers' Affairs and Committee on Social Welfare of the Tokyo Metropolitan Government, etc.

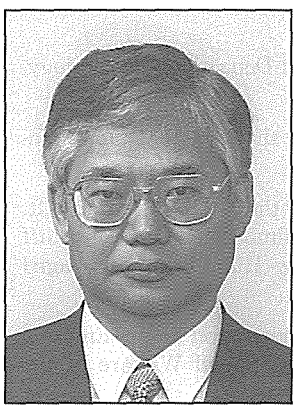
She wrote many publications based on her extensive experiences in mountain climbing.

SESSION3



Hiroshi Murata

Date of Birth : March 10, 1915
Education :
1937 Graduated from Mechanical Course, Ryojun (Port Arthur) Institute of Technology
Career :
1958 First Secretary, Embassy of Japan in U. K.
1963 Director General, Resources Bureau, Science and Technology Agency (STA)
1964 Director General, Planning Bureau, STA
1964 Director General, Atomic Energy Bureau, STA
1967 Executive Director, Power Reactor and Nuclear Fuel Development Corporation (PNC)
1978 President, Japan Atomic Energy Research Institute (JAERI)
1981 President, Nuclear Safety Research Association
1983 President, Nuclear Safety Technology Center
1987- President, Japan Atomic Energy Relations Organization
Other Major Positions : Vice Chairman, Japan Atomic Industrial Forum Inc. (JAIF) ; Chairman of the Steering Committee, International Nuclear Cooperation Center, JAIF ; Special Adviser, JAERI etc.



Shunsuke Kondo

Date of Birth: July 26, 1942
Place of Birth: Sapporo, Hokkaido, Japan

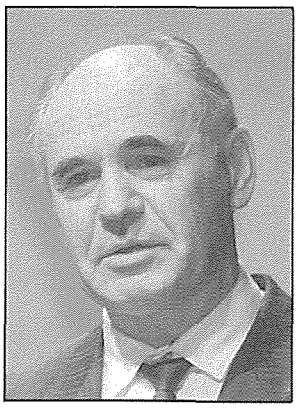
Education:
Bachelor in Nuclear Engineering, 1965, the University of Tokyo
Master in Nuclear Engineering, 1967, the University of Tokyo
Ph.D. in Nuclear Engineering, 1970, the University of Tokyo

Occupational experience:
Lecturer, Department of Nuclear Engineering, University of Tokyo (1970-1972)
Associate Professor, Department of Nuclear Engineering, University of Tokyo (1972-1984)
Professor, Nuclear Engineering Research Laboratory, University of Tokyo (1984-1988)
Professor, Department of Quantum Engineering and System Science (Department of Nuclear Engineering), the University of Tokyo (1988-)
Advisor to Atomic Energy Commission (1979-), Advisor to Nuclear safety Commission (1987-), Advisor to Science and Technology Agency (1980-)

Research interest:
Nuclear Reactor Design, Nuclear Reactor Safety, Human Interface Design, Nuclear Energy Policy, Science and Technology Policy

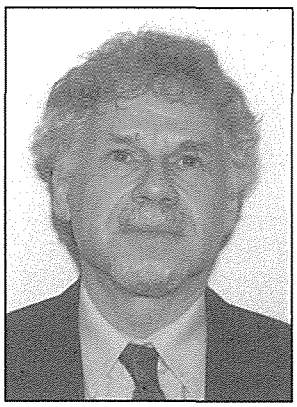
Grahame R. Smith

Grahame Smith, born in 1937, was educated at Stockport School and Imperial College, London where he gained a BSc in Chemistry.
His career in the nuclear industry began in 1959 when he joined Springfields Works as a Technical Assistant. He worked in a variety of production and technical posts until 1982 when he was promoted to Production manager of Chemical Plants. The following year he became Deputy General Manager/Production Manager. In 1984 he moved to Sellafield when he was appointed as General Manager, Windscale Works.
In July 1988 he became Director, Magnox Reprocessing Division and shortly after was appointed Head of Sellafields Site. At the beginning of March 1994 he took up his present position of Director, UK Group and still retains one of his previous titles of Head of Sellafield Site.
Over the last few years, Mr. Smith taken on Directorships with organisations whose main objectives have been to promote the development of the Cumbrian economy.
He is also a Director of NIREX and Fellside Heat & Power, the Chairman of West Lakes Properties, a Board Member of the Prince's Youth Business Trust and Governor of St. Bees School.



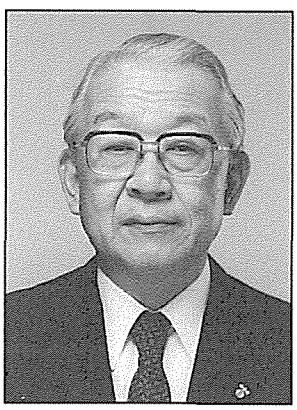
Nikolai Ermakov

Head, Chief Directorate on the Development and Designing of Nuclear Reactors and Special Installations, Russian Ministry for Atomic Energy.
Nikolai Ermakov, born on 1931 in Shemony, Samara, graduated from the Moscow Energy Institute in 1955.
He worked at the Podolsk Gidropress experimental design office until 1986 and then became Head of Chief Directorate at the Ministry for Nuclear Power.
He has registered five inventions and contributed a number of articles to periodicals. He is a member of the Editorial Board of the journal "Atomnaya Energia."
N. Ermakov is a winner of the USSR Council of Ministers Prize and holder of two decorations. Honoured Power Worker of the USSR.
His scientific and technological interests include developing reactors for the nuclear power industry and special-purpose installations.



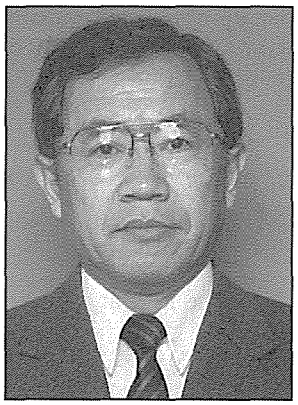
Marvin Miller

Dr. Miller is a senior research scientist with the Department of Nuclear Engineering and the Defense and Arms Control Studies Program at the Massachusetts Institute of Technology (MIT). Previously, he was a professor on the faculty of Purdue University (1967-1974) conducting research on laser theory and applications. His research and teaching at MIT focus on arms control, particularly nuclear proliferation, and the environmental impacts of energy use. He has worked on proliferation issues since 1977, including both country-specific and generic problems. In the former, his main interests are in the Middle East and South Asia, while in the latter he has conducted studies on a variety of issues including: international safeguards and export controls for sensitive nuclear technologies, nuclear-powered submarines in non-nuclear weapons states, the proliferation implications of foreign nationals studying at US universities, the disposition of plutonium from retired nuclear weapons, and, most recently, verification modalities for a cutoff in the production of fissile material for nuclear weapons. From 1984 to 1986, Miller was a Foster Fellow with the Nuclear Weapons and Control Bureau of the US Arms Control and Disarmament Agency (ACDA), and he is currently a consultant on proliferation issues to ACDA and the Lawrence Livermore National Laboratory. In the energy/environmental area he has worked on sub-seabed disposal of nuclear waste and the impact of concerns about greenhouse warming on the energy strategies of developing countries.



Ryo Ikegame

Date of Birth : October 3, 1927
Education: 1952, Graduated from the Electrical Engineering
Division, Engineering Department of the Tokyo University
Occupation:
1952 Entered the Tokyo Electric Power Co., Inc.
1979 General Manager, Nuclear Power Plant Construction Department
1981 Superintendent, Fukushima Daiichi Nuclear Power Station
1983 Director, Deputy General Manager of Nuclear Power Development Center
1985 Director, Deputy General Manager of Nuclear Power Administration
Deputy General Manager of Engineering Research & Development Administration
1986 Managing Director, General Manager of Nuclear Power Administration
1991- Executive Vice-President
Other Major Post:
1992 Chairman, Committee for nuclear power development, The Federation of Electric Power Companies



Keiji Kobayashi

Born in 1939 in Dalian, China.

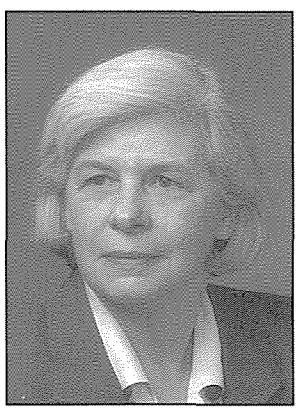
In 1964, he graduated from Department of Engineering (Nuclear Engineering) of Kyoto University. After graduating in 1964, he joined the Research Reactor Institute of Kyoto University, and has been working as Instructor at the Institute until now.

Nobuaki Kumagai

Date of birth: May 19, 1929
1953 Degree of Bachelor of Engineering from Osaka Univ.
1959 Degree of Doctor of Engineering from Osaka Univ.
1960-71 Associate Professor of the Dept. of Communication Engineering, Faculty of Engineering, Osaka Univ.
1971-85 Professor of the Dept. of Communication Engineering, Faculty of Engineering, Osaka Univ.
1985 Dean of Faculty of Engineering, Osaka Univ.
1985-91 President of Osaka Univ.
1991- Professor Emeritus of Osaka Univ.
1992- President and Director General of the Institute of Nuclear Safety System, Inc.
1993- Commissioner of the Council for Science and Technology.

Currently, he holds a number of titles such as: President of the Council for Promotion Optical and Quantum Science and Technology; Chairman of the Frontier Research Promotion Committee of the Ministry of Posts and Telecommunications; Member of the Science and Technology Agency's Advisory Committee on Long-term Program of the Research, Development and Utilization of Nuclear Energy, Member of National Land Development Council; Advisor of the Institute of Physical and Chemical Research; Member of the Engineering Academy of Japan, etc.

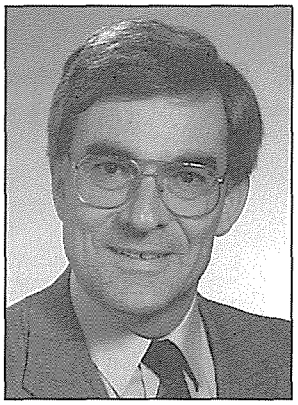
Maurice Allègre



Susan Wiltshire

Susan Wiltshire is Vice president of JK Research Associates, Inc., a research and consulting firm specializing in policy formulation, strategic planning, and external involvement planning for technical programs. Her expertise in these areas results from her extensive experience as a citizen activist, consultant, local official, and member of numerous state and national advisory groups.

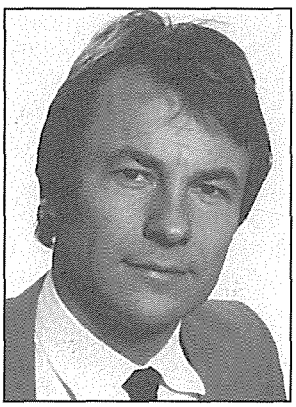
Ms. Wiltshire serves on the U.S. Environmental Protection Agency Advisory Committee on Radiation Site Cleanup Regulation and has chaired its committee on the Waste Isolation Pilot Plant. She also chairs the National Academy of Sciences' National Research Council Committee to Review New York State's Siting and Methodology Selection for Low Level Radioactive Waste Disposal. Ms. Wiltshire has served a number of other National Research Council Committees including the Committee on Technical Bases for Yucca Mountain Standars, the Committee to Review Risk Management in the DOE's Environmental Remediation Program, and the Panel on Separations Technology and Transmutation Systems, and the Board on Radioactive Waste Management and the Committee on Risk Perception and Communication. In 1955, Wiltshire graduated Phi Beta Kappa with High Honors from the University of Florida, receiving a BS in mathematics.



Hans Issler

Date and place of birth: 19th November 1943 Davos, Switzerland
Nationality: Swiss
History and degree of education:
- University Zürich:
  Graduated in Nuclear Physics (1969)
- Swiss Federal Institute of Technology:
  Post-diplome studies in industrial engineering

Occupation: President of Nagra
Business career:
1977 Managing Director of Nagra (National Cooperative for the Disposal of Radioactive Waste)
1988 President of Nagra



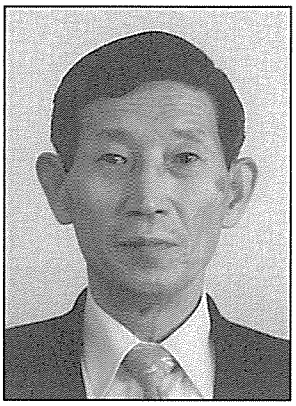
Claes Thegerström

Date, place of birth: Born 13 November, 1947, in Mönsteràs, Sweden
Nationality: Swedish
History and degree of education, occupation and business career:
Studies in Engineering Physics, Nuclear Physics and Environmental Sciences at Lund University and Institute of Technology.
20 years professional experience in the areas of radioactive waste management, safety assessment and environmental protection.
Worked with Studsvik Research Centre 1974-82, Eurochemic Reprocessory Plant, Belgium, 1976-77, Swedish Nuclear Fuel and Waste Management Co (SKB) 1982-86, OECD/Nuclear Energy Agency in Paris 1986-91 Int'l Coop on Assessment of long term safety of radwaste management.
Since 1992 responsible at SKB for siting and technical. planning of a deep repository in Sweden.

Atsuyuki Suzuki

Born in Tokyo on October 31, 1942.
Career:
1985- Professor, Dept. of Nuclear Engineering, University of Tokyo
1977 Associate Professor, Ditto,
1975 Research Associate Ditto,
1974 Research Staff, The International Institute for Applied Systems Analysis, Laxenburg, Austria
1971 Research Associate, Nuclear Engineering Research Laboratory, the University of Tokyo, Ibaraki.

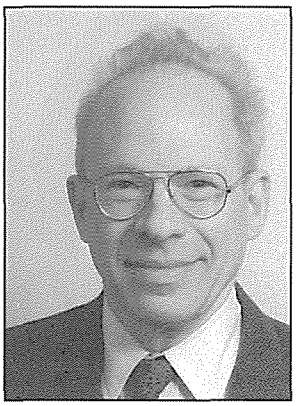
Educational Background:
Ph.D in Nuclear Engineering (1971) ; MS in Nuclear Engineering (1968) ; BS in Nuclear Engineering (1966). All from the University of Tokyo.
He is also Members of the Special Committee, Atomic Energy Commission, the Special Committee, Nuclear Safety Commission, and the Special Committee, Advisory Council on Energy, Agency of Natural Resources and Energy, MITI.



Hiroshi Tsuchida

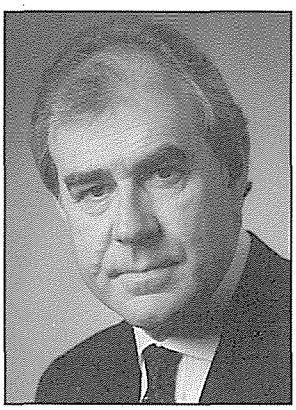
Born on December 10, 1931
In 1948, he graduated from Yamagata Prefectural Sakata High School and in 1959, he graduated from Hokkaido Nohoro Dairy Farming Junior College.
In 1975, he was elected a member of Rokkasho Village Assembly in Aomori Prefecture for the first term. After serving as a member of the Assembly for four terms from April 1975 to December 1989, he was elected the Mayor of Rokkasho Village.
Currently, he holds more than 30 titles with organizations such as Aomori prefectural conference of supervision concerning environmental radioactivity monitoring of the Nuclear Fuel Cycle Facilities, Aomori Prefectural Council of Mutsu-Ogawara Development, and Mutsu-Ogawara Industrial Development Foundation.

SESSION5



Richard L. Garwin

Richard L. Garwin is IBM Fellow Emeritus at the Thomas J. Watson. Research Center and member of the Committee on Arms Control and National Security (CISAC) of the National Academy of Sciences. He is also Acting Chairman of the Science and Policy Advisory Committee of the U.S. government's Arms Control and Disarmament Agency, Adjunct Professor of Physics at Columbia University, and has been Professor of Public Policy at Harvard University, member of the President's Science Advisory Committee, member of the Defense Science Board, and a consultant to the Defense Department and other agancies of the U.S. government, including the Los Alamos National Laboratory.
He earned a Ph. D. in Physics from the University of Chicago in 1949.
His contributions to the development, analysis, and choice of weapon systems extend from 1950 to the present and include many technologies including those of communications, surveillance, navigation, propulsion, and the like. He has published many papers, both classified and unclassified, on defense technology and arms control, energy, transportation, and environment, and has testified to many congressional committees in both closed and open session.
He is also a member of the National Academy of Sciences, the Institute of Medicine, the Council on Foreign Relations, the International Institute of Strategic Studies, and other honorary and professional organizations.
Over the last 20 years he has published many articles dealing with the technical and policy aspects of energy and nuclear power, and the control of nuclear weapons.



Richard Butler

Richard Butler took up appointment as Australian Ambassador and Permanent Representative to the United Nations in March 1992.
He was born in New South Wales, Australia, in 1942. He holds degrees from the University of Sydney and the Australian National University.
In 1983 he was appointed Australia's first Ambassador for Disarmament. In that role he led the Australian Delegation to the Conference on Disarmament in Geneva and was charged with conducting all Australian disarmament negotiations, both in United Nations institutions and, directly, with individual countries.
In 1989 he was oppointed Australian Ambassador to Thailand and, simultaneously in 1991, Ambassador and Permanet Representative of Australia to the Supreme National Council of Cambodia.
In 1992 the General Assembly of the United Nations elected him Chairman of the United Nations Preparatory Committee for the Fiftieth Anniversary of the United Nations, in 1995.
In 1994 he was elected President of the Economic and Social Council of the United Nations.
In September 1995, he was made a Fellow of the Foreign Policy Association, New York.
In November, 1995 the Prime Minister of Australia appointed him Governor of the Canberra Commission on the Elimination of Nuclear Weapons.

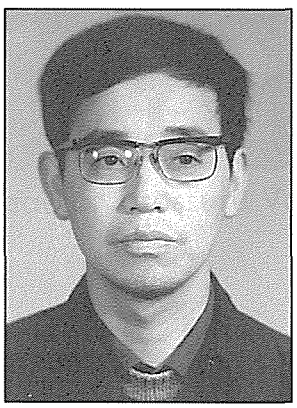
Ryukichi Imai

Born in Tokyo
Education:
University of Tokyo (M. S. in mathematics), Dr. Eng. (nuclear engineering) , Harvard University (M.A.), Fletcher School of Law and Diplomacy (A.M.)
Career:
Science Reporter, Asahi Shimbun
General Manager, Engineering, Japan Atomic Power Co,
Ambassador Extraordinary and Plenipotentiary of Japan to Kuwait, Conference on Disarmament (Geneva), and Mexico

Counsellor, Atomic Energy Commission
Senior Advisor, Japan Atomic Industrial Forum
Distinguished Scholar, International Institute for Global Peace
Visiting Professor, Sophia University

Authorship: Science and Nation, Nuclear Safeguards (IISS Adelpji paper), Nuclear Power and International Politics, Nuclear Energy and Nuclear Proliferation (Westview), Disarmament II (OG & H), Nuclear Disarmament Post Cold War Management of Nuclear Weapons (1992) and others.

J. Mercado



Mingquan Zhu

Professor of International Relations, and Deputy Director of the Center for American Studies, Fudan University, Shanghai, China.

He also co-chairs with Dr. Dingli Shen the Program on Arms Control and Regional Security at the CAS. He has written extensively on international relations, international security, US defense policy and foreign policy. His latest publications include "International Relations" (with Prof. Ming Yuan), "Nuclear Proliferation: Danger and Prevention, US National Security Policy (forthcoming) and a series of articles.

Prof. Zhu's present researches are on US defense policy in the post-Cold War and theories and practice of arms control. He was a visiting scholar in State University of New York at Albany, Princeton University, Emory University, University of Maryland at College Park, and Harvard University. He has been invited to teach in Emory University for a semester and attend many international conferences in Hong Kong, US, Germany and Canada.

He graduated from Peking University (1968) and Nanjing University (1981) as undergraduate and graduate student.

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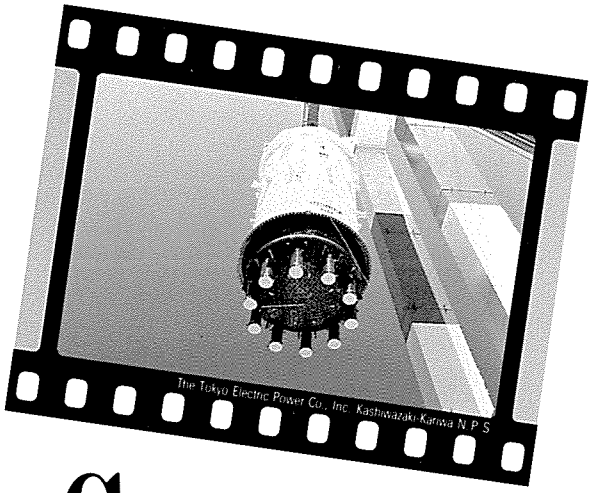

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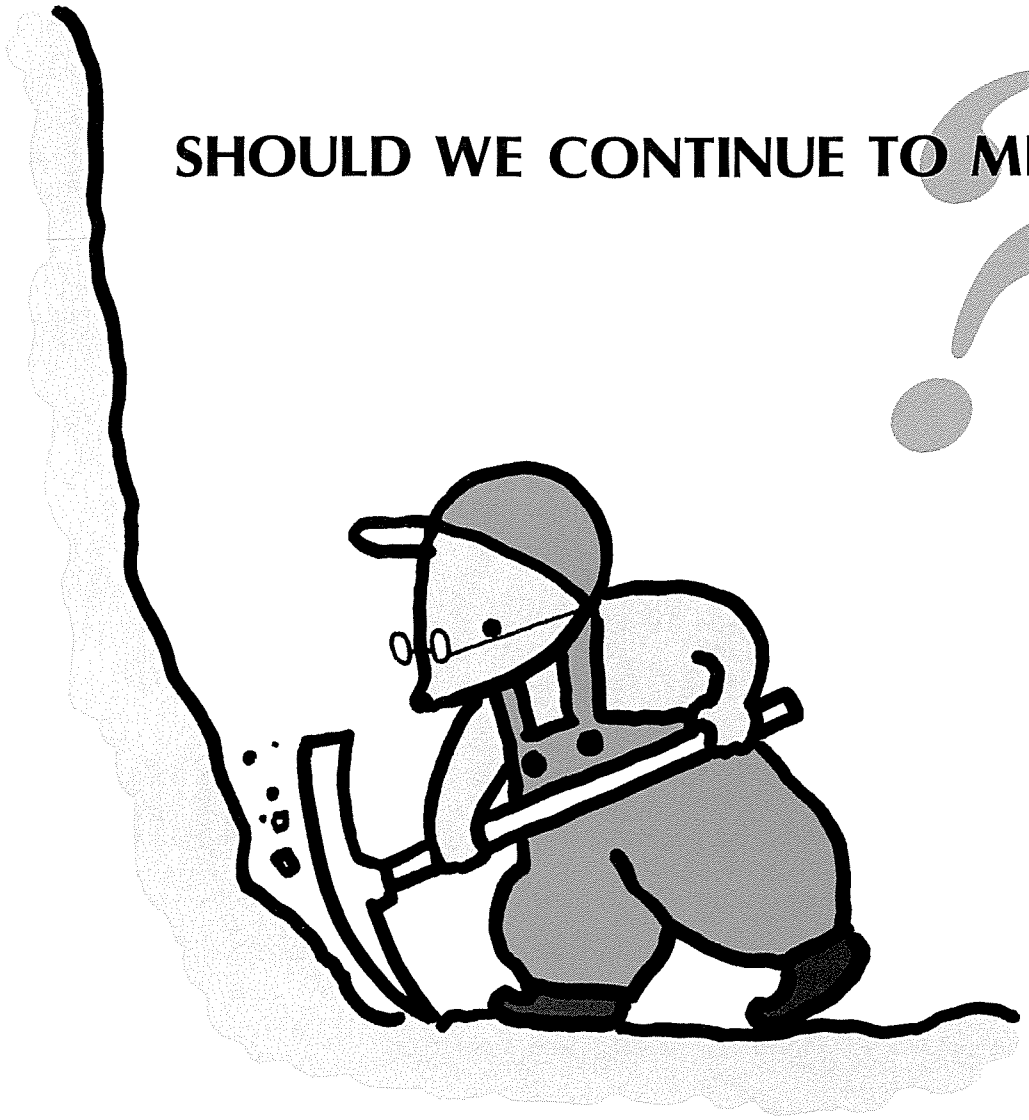
SHOULD WE CONTINUE TO MINE ?



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