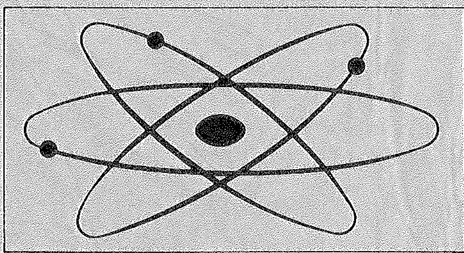
17th

JAIF

ANNUAL CONFERENCE ABSTRACT



March 13-15, 1984

Nissho Hall

Japan Atomic Industrial Forum

MEMBERS OF THE PROGRAM COMMITTEE FOR THE 17TH JAIF ANNUAL CONFERENCE

(in Alphabetical Order)

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	Hisashi Nagahashi	Executive Director, The Federation of Electric Power Companies
	Sakae Nagaoka	News Commentator, NHK (Broadcasting Corporation of Japan)

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	Toshio Takaichi	Senior Managing Director, FBR Engineering Co., Ltd.
	Shun'ichi Takebe	Science Editor and Editorial Writer, The Asahi Shimbun
	Shigefumi Tamiya	Managing Director, Japan Nuclear Fuel Service Co., Ltd.
	Masatoshi Toyota	Managing Director and General Manager, Nuclear Power Development Center, The Tokyo Electric Power Co., Inc.
Observers	Yukinobu Takaoka	Director General, Atomic Energy Bureau, Science and Technology Agency (then)
	Hidetoshi Ukawa	Director General for Scientific and Technological Affairs, Ministry of Foreign Affairs
	Yasushi Matsuda	Counsellor, Director General's Secretariat, Agency of Natural Resources and Energy, Ministry of International Trade and Industry

BASIC THEME

PRESENT AND FUTURE OUTLOOK OF NUCLEAR INDUSTRY IN LOW-GROWTH ECONOMY

Nuclear industry in low-growth economy has various problems. Nuclear power, as a mainstay of alternative energy sources to oil, can play a much greater role in the economics of society as it becomes commercialized.

We plan to focus on revitalizing the nuclear industry by emphasizing the economics of LWR and upgrading LWR technology. The construction cost of nuclear power is to remain competitive with other power sources.

Public acceptance is important for the smooth promotion of nuclear facilities. The people concerned with nuclear energy development should take appropriate measures to cope with new situations as they arise.

The policy related to the backend of the nuclear fuel cycle should be reviewed.

Japan is also expected to fullfill her role in the international community by entering into cooperation efforts in various fields of nuclear energy. We must explore measures to make these international efforts more effective.

The 17th JAIF Annual Conference

Present and Future Outlook of Nuclear Industry in Low-Growth Economy

Program

13 - 15 March 1984
Nissho Hall, Tokyo

Tuesday 13 March

9:30 am - 10:40 am
Opening Session

	Chairman: Gaishi Hiraiwa		President Tokyo Electric Power Company, Inc.
9:30	Remarks by Chairman of Program Committee		
		Hiroshi Narita	President Central Research Institute of Electric Power Industry
9:50	JAIF Chairman's Address		
		Hiromi Arisawa	Chairman Japan Atomic Industrial Forum, Inc.
10:20	Remarks by Chairman of the Atomic Energy Commission		
		Michiyuki Isurugi	Chairman Atomic Energy Commission Minister of State for Science and Technology

10:45 am - 5:30 pm
Session 1 Future Trends of Energy Problems and the Role of Nuclear Power

	Chairman: Minoru Yoshida		President Power Reactor and Nuclear Fuel Development Corporation
10:45	The Importance and Perspectives of Nuclear Power Development in Czechoslovakia		

	Stanislav Havel	Chairman Czechoslovak Atomic Energy Commission
11:15	French Nuclear Program, 10 Years after the First Oil Crisis	
	Gérard Renon	Administrateur Générale Délégué Commissariat a l'Energie Atomique
	Intermission 12:00 - 14:00	
	Chairman: Hideo Abe	President and Representative Director Fuji Electric Company, Ltd.
14:00	The Development of Nuclear Energy and International Cooperation in China	
	Gan-Chang Wang	Vice President Commission of Science and Technology Ministry of Nuclear Industry
14:30	Nuclear Power in the United States: A Current Assessment	
	Wallace B. Behnke	Chairman Atomic Industrial Forum, Inc.
	Chairman: Minoru Okabe	President Japan Atomic Power Company, Ltd.
15:15	The Role of Nuclear Power in the Energy Policy of Japan	
	Toyoaki Ikuta	President The Institute of Energy Economics
16:00	Nuclear Energy Policy in the United States (Tentative Title)	
	Shelby T. Brewer	Assistant Secretary, Nuclear Energy U.S. Department of Energy
16:45	The Energy Issues and Prospects on Nuclear Power Development in the Federal Republic of Germany	
	Günter Lehr	Director General Department for Energy and Technology Federal Ministry of Research and Technology

6:30 pm - 8:00 pm
JAIF Chairman's Reception

Room "AKEBONO"
HOTEL OKURA
(South Wing 2nd Basement)

Wednesday 14 March

9:30 am - 12:00 noon
Session 2 Vitalization of the Nuclear Industry

	Chairman: Keigo Haratani		Chairman Hokuriku Electric Power Company, Ltd.
9:30	Expectation to the Nuclear Power Generation		
	Tsunenori Yamaguchi		Chairman Shikoku Electric Power Company, Ltd.
10:00	INPO and the Vitalization of the Nuclear Industry		
	Eugine P. Wilkinson		President Institute of Nuclear Power Operations
10:30	The Operating Experience of French PWR		
	Bernard Méclot		Chef de Division au Departement Exploitation Sûreté Nucléaire Electricite de France Member of UNIPEDE
	Chairman: Shoichi Saba		President and Chief Executive Officer Toshiba Corporation
11:00	Nuclear Component Supplier - Prospects and Imposed Tasks		
	Soichiro Suenaga		President Mitsubishi Heavy Industries, Ltd.
11:30	Nuclear Power as Viewed from Construction Standpoint		
	Yorihiko Ohsaki		Executive Vice President Shimizu Construction Company, Ltd.

12:20 pm - 2:15 pm
Conference Luncheon

Room "AKEBONO"
HOTEL OKURA
(South Wing 2nd Basement)

Remarks:

Hikosaburo Okonogi	Minister of International Trade and Industry

Special Lecture: "Divergence and Convergence"

Hidetoshi Kato	Professor Gakushuin University

1:00 pm - 2:15 pm
Films

Nuclear Energy Development and Utilization (Produced by STA, 27 minutes, in Japanese)
Reviving Dunes (Produced by TEPCO, 27 minutes, in Japanese)
30 Years' Reprocessing in France (Produced by COGEMA, 16 minutes, in English)

Conference Hall

2:30 pm - 5:30 pm
Session 3 Development Strategy of the Back-End of Nuclear Fuel Cycle

(Panel Discussion)

Chairman: Yoichi Takashima
Professor
Saitama University

Keynote: Sidney M. Stoller Chairman
The S.M. Stoller Corporation

Panelists:

Claude F.J. Ayçoberry	Directeur de la Branche Retraitement COGEMA
Klaus G. Janberg	General Manager GNS Corporation
Kermit O. Laughon	Director Office of Spent Fuel Management and Reprocessing Systems U.S. Department of Energy

Günter Lehr	Director General Department for Energy and Technology Federal Ministry of Research and Technology
Sir Walter Marshall	Chairman Central Electricity Generating Board
Masatoshi Toyota	Managing Director Tokyo Electric Power Company, Inc.
Kunihiko Uematsu	Director Power Reactor and Nuclear Fuel Development Corporation

<u>Thursday 15 March</u>

9:30 am - 12:30 pm
Session 4 A New Stage of International Cooperation in Nuclear Energy

(Panel Discussion)

Chairman: Hiroshi Murata
Chairman
Steering Committee for International Cooperation Center
Japan Atomic Industrial Forum, Inc.

Keynote: Takehisa Shimamura
Commissioner
Atomic Energy Commission

Panelists:

Carlos Vélez Ocón	Deputy Director General for Technical Cooperation International Atomic Energy Agency
George A. Pon	Senior Vice President CANDU Operations Atomic Energy of Canada Limited
Mohamad Ridwan	Deputy Director General National Atomic Energy Agency

Noboru Amano	Vice President Japan Atomic Energy Research Institute
Akio Horiuchi	Science Counsellor Minister's Secretariat Atomic Energy Bureau Science and Technology Agency
Kun-Mo Chung	Chairman and President Korea Power Engineering Company, Inc.
L. Manning Muntzing	Past President American Nuclear Society

2:00 pm - 5:00 pm
Session 5 Bearing of Nuclear Power on Public Acceptance

Chairman: Sakae Nagaoka — News Commentator, NHK (Broadcasting Corporation of Japan)

14:00 Economic and Social Impact of Nuclear Power Plant on Local Community

Hitoshi Sasao	Professor Nihon University

14:40 Safety Regulation and Public Acceptance (Tentative Title)

Thomas M. Roberts	Commissioner U.S. Nuclear Regulatory Commission

15:20 Radioactive Waste and Public Acceptance

Howard K. Shapar	Director General OECD Nuclear Energy Agency

16:00 New Technology and Public Acceptance

Toshikazu Shibata	Professor Kyoto University

Tuesday 13 March

10:45 am - 5:30 pm

SESSION 1 FUTURE TRENDS OF ENERGY PROBLEMS AND THE ROLE OF NUCLEAR POWER

Since the two oil crises which shocked the world motivated major countries to cut down their dependence on oil, they have tried to achieve actual energy conservation and develop alternative energy sources. Although a reverse oil shock in the spring of 1983 eased the demand-supply balance of oil, they are still trying to move away from oil. They are giving greater importance to the role of nuclear power and coal as the mainstays of alternative energy sources. At a time when nations, amid circumstances of slow economic growth, are at a turning point in energy policy, their actual conditions will be reviewed in this session with a view to setting a course for the development of nuclear power.

THE IMPORTANCE AND PERSPECTIVES OF NUCLEAR POWER DEVELOPMENT IN CZECHOSLOVAKIA

Stanislav Havel
Chairman
Czechoslovak Atomic Energy Commission
Czechoslovakia

To secure the supply of fuel and power in Czechoslovakia is nowadays prevailingly determined by natural conditions and investments possibilities of further coal mining, the reserves of which represent practically the only sources of fossile fuels, then by technical and economical possibilities of fuels importations, especially of oil and natural gas and fainally by possibilities of construction of nuclear power plants for electricity and heat generation.

Reserves of bituminous and brown coals accesible for mining, are relatively limited. With respect to the deteriorated mining and geological conditions, especially to a necessity to descend to lower levels both in surface and deep mines, the technical and investment prepositions are becoming more complex and for this reason, as well as with respect to a special attention paid to the environmental protection problems, it is foreseen to decrease successively the quantities of mining both of bituminous and brown coals.

Nuclear power represents thus for Czechoslovakia the unique source of energy able of a long term dynamic development, that is going to play in the next 50 years an irreplacable role in securing the sources of primary energy.

Till the year 2000 nuclear power plants will take over the decisive percentage of the output and production balance of electricity, i.e. more than 60%. Nuclear power generating plants are intended for heat supply as well.

Czechoslovakia is developing its nuclear power programme as a part of the joint programme of countries belonging to the Council of Mutual Economic Assistance, based on a significant assistance of the Soviet Union. At the first stage, the nuclear reactors of VVER type are being constructed. Upon termination of 12 units of VVER-440 type, it is intended beginning in early nineties, to lance a long term programme of construction of VVER 1000 reactor type.

The Czechoslovak industry is participating in a decisive way in the fulfilment of this nuclear power programme. Our nuclear power engineering industry has acquired knowledge of manufacturing important components of nuclear power plants, from which some of them became a part of Czechoslovak exportations within the framework of CMEA countries co-operation. The possibilities of Czechoslovak building industry are fully utilized for construction of nuclear power plants.

The concept of research activities in Czechoslovakia in the field of nuclear power and corresponding development of the scientific and research basis has been since the very beginning closely connected with the co-operation with the Soviet Union and attached to other agreements concluded among CMEA countries.

In the present time research and development tasks are being particularly oriented at:

- systems problems of nuclear power development, including the management and NPPs construction
- problems of safety, reliability and economics of operation
- problems of radioactive wastes treatment and safe disposal
- problems of development of selected fast breeders components
- particular problems of nuclear fuel cycle.

The operation of nuclear power plants with PWRs proved that nuclear power plants are a safe and reliable source contributing to electricity system.

A special attention is being devoted to problems of nuclear safety and environmental protection. An important task is being connected with the Czechoslovak Atomic Energy Commission that has been entrusted with the performance of Nuclear Safety Governmental Organization.

FRENCH NUCLEAR PROGRAM, 10 YEARS AFTER THE FIRST OIL CRISIS

Gérald Renon
Administrateur Général Délégué
Commissariat a l'Énergy Atomique
France

Shortly after the oil crisis of 1973, countries heavily dependant on oil imports, like France and Japan, had to take up the challenge of fast rising energy costs. They have reacted by implementing energy policies directed towards three main objectives: rational use of energy, diversification of energy sources and origins, and search of a more independant energy supply.

In order to reach the goals of diversification and independance, France among other actions has launched in 1974 an important nuclear program. Ten years later a first assessment of its achievements can be made. It appears that the results are rather satisfying. The ratio of independance set at 40 per cent to 45 per cent for 1985, as compared to 25 per cent in 1973, will be attained. Now the aim is over 50 per cent for 1990. Electricity from nuclear power plants amounted to 2 per cent of the country's primary energy balance in 1973, in 1985 it will exceed 20 per cent of the total energy consumption. The ratio of nuclear generated electricity to total electricity generation was 8 per cent in 1973, it has exceeded 50 per cent today and will be over 70 per cent in 1990.

The economic edge of nuclear power over electricity generated coal fired stations has slightly fluctuated through the considered period of time but has remained substantial. Besides, it has to be reminded that the weak impact of the fuel cost on the total cost of the nuclear kWh (about 10 per cent) leaves the latter relatively insensitive to uranium price variations, whereas the cost of fuel is prevailing for the kWh issued from fossil fuel.

The power station operation has proved satisfactory also, since the 27 reactors connected to the grid, 3 years old in the average, had reached in 1983 an availability factor close to 68 per cent. This figure is higher than 75 per cent for the 13 stations which have been operating for more than two years.

Such operating performances, the lack of any notable failure affecting the safety of plants, the level of concentration with local authorities and populations, the perception by them of the local and national benefits of the nuclear power program, and in particular the feeling of the necessity of resorting to nuclear energy to palliate the country's scarcity in fossil resources explain the endorsement from the public opinion to the French nuclear power development program.

Considering that the main objectives set to the nuclear power program are already reached or nearing completion, taking also into account the slowing down anticipated for the mean term of the economic rate of growth, the French government has decided in July 1983 to adjust the pace of new orders, to promote the penetration of electricity into the French energy system, in particular for industrial uses, and to foster electricity exports.

France is committed all over the various steps of the nuclear fuel cycle. The activities of the French mining companies, the largest of which is COGEMA, grant the country a diversified supply and ensure a strong position on the world market. About 25 per cent of the world uranium production are controlled by French interests. The operation of the Eurodif enrichment plant is thoroughly satisfactory and allows most attractive enrichment service offers. In the field of fuel manufacturing the French industrial capacities are large enough to face the country's need for both light wate and fast breeder reactor fuel assemblies. The first core of the Superphénix station has been fabricated under the most satisfactory conditions. In the fuel reprocessing field, COGEMA's La Hague plant has processed in 1983 fuel from different types of reactors: Gas-graphite, breeder, and LWR. Only for the latter, 221 tons have been processed, so that the cumulative production of oxide fuels reprocessed at La Hague, more than 700 tons, exceeds half of the total amount reprocessed in the world.

All thse results can still be improved. Various actions of R and D are being developed to increase the availability, reliability and safety of the power stations as well as of the nuclear fuel cycle facilities. For instance, the contribution of power plants to grid load-following and to frequency control is progressively being implemented. Experiments are conducted to improve further fuel burn-up so as to reduce plants shut-down durations and operators integrated irradiation doses.

Work is proceeding on the subject of plutonium thermal recycling and on advanced concepts of pressurized water reactors improving the conversion rate. In the nuclear fuel cycle field, the construction of new facilities at La Hague is progressing according to schedule, while activities of R and D are conducted in particular for long term disposal of radioactive wastes.

In the meantime, activities are directed toward the development of future technologies. It is the case in the enrichment field where advanced technologies like isotopic separation technique using laser beams are reaching a phase of early development. In the field of fast breeder reactors France took the initiative of proposing an extension of the international cooperation in order to join forces to favour their commercial penetration. A government level agreement between France, the Federal Republic of Germany, Belgium, Italy and the United Kingdom has been concluded in January. It opens the way to a network of specific agreements between R and D organizations, between industrial companies and between power utilities on reactors as well as on the fuel cycle. Such a strengthening of the links joining Europeans partners must not be interpreted as geographically exclusive. On the contrary, it must be considered as the setting up of a first core open to cooperation with the other partners already committed in the field, like Japan and USA.

THE DEVELOPMENT OF NUCLEAR ENERGY AND INTERNATIONAL COOPERATION IN CHINA

Wang Ganchang
Vice President
Commission of Science and Technology
Ministry of Nuclear Industry
China

The development of four modernizations have reached a new stage in China. For solving the problem of very uneven distribution of energy resources, China has decided to develop the nuclear energy, the long term nuclear program will soon be determined. Now, Qinshan Nuclear Power Plant, Guangdong Nuclear Power Plant and Hinshan Nuclear Heat and Power Plant are the construction items intended to build. The designs are being carried out under firm grasp.

Our basic policy to develop nuclear industry is to rely mainly on our own efforts. The transfer of advanced technology from foreign countries will be welcome. Their successful experiences of constructing nuclear power plants are valuable to us. We are willing to cooperate with them on the basis of equality and mutual benefit. For example: we have begun cooperation with France on nuclear power plants construction.

During recent years, the scientific and technologic cooperation agreements on peaceful use of nuclear energy between China's Ministry of Nuclear Industry and organization of foreign countries were signed. The exchanges and cooperations on peaceful use of nuclear energy are gradually increasing. The practices indicate that inter-government agreements are necessary for nuclear cooperation to promote the effective development of civil exchange activities.

Japan is a friendly close neighbor of China separated only by a narrow strip of water. Each side has its own superiority and own needs in resources and technology respectively. It is necessary to strengthen the cooperation and get another side's strong points to offset one side's weaknesses. Sino-Japan cooperation on peaceful use of nuclear energy should be more effective and more comprehensive.

NUCLEAR POWER IN THE UNITED STATES
A CURRENT ASSESSMENT

Wallace B. Behnke, Jr.
Chairman, Atomic Industrial Forum
and
Vice Chairman, Commonwealth Edison Company
U.S.A.

Nuclear power in the United States today is a story of contradictions.

By way of illustration, one needs only to point to the four large new reactors that started operating last year, even while five reactors of comparable size were being cancelled. This year, 13 more large reactors will be completed and go into operation. And yet, four more cancellations have so far been announced this year and there could be more before the year is ended.

In 1982, the most recent year for which comprehensive data on U.S. power production is available, nuclear generated electricity was 11% cheaper than electricity generated with coal and 55% cheaper than electricity generated with oil. Within another few months, comparable data on 1983 operations should be available. I expect nuclear power to retain its economic edge. But because of higher price tags for some of the nuclear plants that have come on line since the last survey was conducted, I expect nuclear power's advantage to have narrowed somewhat.

Even while some nuclear power plants were being completed and others were being cancelled, public debate on the future viability of nuclear power continued. It is a debate that is taking place largely outside the context of the country's future energy needs and with little acknowledgement of the contribution now being made or expected to be made in the future by the 76 central station nuclear power plants now in commercial operation, the seven in various stages of startup, and the 48 still under construction.

It will be the intent of this paper to describe how a reduced growth in the demand for electricity, high interest rates, double digit inflation, and excessive regulation have impacted operating plants, plants under construction and plants in the planning stage. The paper will undertake to explain why operating plants continue to be a success story, why plants under construction continue to be a mixed story, and why the long-term outlook for nuclear power remains good. Finally, the paper will define some objectives and strategic initiatives that might be taken to put nuclear power in a better position to play a major role in meeting tomorrow's electric power needs not only in the U.S. but in other parts of the world as well.

THE ROLE OF NUCLEAR POWER IN THE ENERGY POLICY OF JAPAN

Toyoaki Ikuta
President
The Institute of Energy Economics
Japan

The history of the energy policies of Japan after the Second World War can be best described by defining four periods of different features.

The first period was the term just after the end of the war and until around 1960, during which all efforts were concentrated for the rehabilitation of Japan's economy which had suffered from the unfortunate effect of the international conflicts. During this period, the atmost priority was placed on the production of coal.

The second period can be defined as the time from 1960's to 1973, when the first oil shock was experienced, during which abundant supply of low priced oil was available for Japan and the nation experienced a remarkable growth of its economy.

The third period started in 1973 when the first oil shock happened, and going through the second oil shock, continued to recent years. During this period, the instability of the oil supply and the escalation of oil prices has forced the energy policy of Japan to adopt drastic alterations. The policy efforts for conservation of energy, and shifting energy recourses to the non-oil fuels has been pursuied strenuously and resulted in considerable awards.

The fourth period is the one to which we are about to enter. The speaker wishes to take the liberty of naming it the "period of complex energy utilization." In the comming period, rational and reasonable ways of utilizing all forms of energy sources including oil must be developed and coordinated.

If we look upon the course of development of nuclear power in the context of transitions of periods described above, the nuclear power entered the stage of experimental use in the first period. In the second period, the nuclear power was given the opportunity for a wide commercial applications by the growing economy. In the third period, the nuclear power was abruptly given the stardom, not only because it obtained economical hedge due to the hike in the oil price, but its stability in the energy supply looked much better.

It is reasonable to perspect that the nuclear power will play predominant roles in the comming period of "complex energy utilization." Although there are observations that the economical advantage of the nuclear power is fading in the recent energy market where the energy prices are week, a more detailed analyses indicate the cost advantage of nuclear power, if estimates are made in the long term. And it should be a matter of good common sense that the merits of the nuclear power would increase with time. It is too naive to conclude that the cost advantage should be lost in future.

The stability of the nuclear power as energy source must be observed with more attention than economy. This point of view is especially pronounced in Japan which has trivial indigenous resources and heavily depends on import of energy.

The evaluation of the economy of the nuclear power is naturally essential in steering energy policies in the comming period of complex energy utilization, and efforts should be made in increasing the economy of nuclear power. A very objective evaluation must be made on the stability of the energy supply of nuclear power. Even in a hypothetical situation in which the economic advantage of nuclear power is lost, the role of nuclear power as the stable source of energy supply are retained.

NUCLEAR ENERGY POLICY IN THE UNITED STATES

Shelby T. Brewer
Assistant Secretary, Nuclear Energy
U. S. Department of Energy
U. S. A.

THE ENERGY ISSUES AND PROSPECT ON NUCLEAR POWER DEVELOPMENT IN THE FEDERAL REPUBLIC OF GERMANY

Guenter Lehr
Director General
Department for Energy and Technology
Federal Ministry of Research and Technology
F. R. Germany

The development of the peaceful utilization of nuclear energy in the Federal Republic of Germany started in 1955. Today about 21 percent of the country's electricity demand is covered by nuclear power. By 1990 this share will be about 35 percent. Nuclear energy utilization will above all increase because of its good economic and environmental record as compared with other energy sources.

To expand nuclear energy utilization, the respective technologies must be further developed. For the light-water reactor this means high availability and low maintenance as well as high safety standards. Development of high-temperature reactors and fast breeders is of priority. High-temperature reactors are promoted because of their potential not only for electricity generation but also for process heat generation and district heating.

Fast breeders cannot be renounced by highly industrialized countries with little resources such as the Federal Republic of Germany because of their potential for better uranium utilization.

Prototypes for both reactor lines are under construction. As for the breeder reactor there is a close cooperation between several European countries (Germany, France, Italy, Belgium, The Netherlands, United Kingdom) which will still be intensified in future. To be more flexible as to the application of nuclear energy, small nuclear power stations are being developed based on the light water as well as on the high-temperature reactor technology. These new plants are characterized by high reliability, economy of operation, simplicity of design and low maintenance requirements.

Research and development in all mentioned fields is either carried out by industry or jointly by state, national laboratories and industry.

The nuclear fuel cycle in the F. R. G. is organized with the private industry except the nuclear waste disposal – planned in geological formations – which is the role of the government according to the atomic energy law.

As for uranium enrichment, Germany is a partner in the trilateral Urenco co-operation and participates in the capacity of 2000 t SWU by construction of the first plant in Germany. Initial capacity will be 320 t SWU, a start up is scheduled for 1985.

The back end of the fuel cycle is of central importance for nuclear power utilization, and the German policy follows the so-calling "integrated spent fuel and waste management concept." This concept asks for reprocessing of spent fuel as the feasible, safe and economically justifiable solution. The technology also is necessary in the long term of nuclear energy supply, especially for FBR utilization. Construction of a reprocessing plant with a capacity of 2 mthm day is scheduled to start in 1985, licence application already proceeds.

Direct disposal of spent fuel is under investigation since 1981 studying the aspects of feasibility and possible safety advantages. It cannot be looked at present as an alternative to reprocessing, but could prove to be an additional measure.

Waste conditioning is commercially available. The German demonstration plant for the vitrification of high level wastes, Pamela, nears completion end of 1984 with hot started up end of 1985.

As for radioactive waste disposed two projects are under investigation. The former iron ore mine Konrad as a repository for special kinds of not heat producing waste is expected to start in 1989. The salt dome of Gorleben is foreseen for a repository of all kinds of waste, including high level wastes. Underground exploration is necessary to validate the site.

As concerns recycling of nuclear fuel, Germany has aquired valuable industrial experience in the fabrication of MOX fuel elements and its successful demonstration LWR operation.

Altogether, the German nuclear fuel cycle activities are based on 20 years of R & D and industrial experience. The completion of the waste management concept will lead to the commercial scale operation before the turn of the century.

Wednesday 14 March

9:30 am - 12:00 noon
SESSION 2 VITALIZATION OF THE NUCLEAR INDUSTRY

Experience in the construction and operation of nuclear power plants has enabled us to make a number of improvements in LWR technology resulting in plants showing a high availability factor. We have enabled nuclear power to take root as an economically superior form of electricity generation. As the faltering demand for electricity seems to bring a difficult phase in the development of the nuclear industry, we are now getting together to explore methods for maintaining and vitalizing the integrity of the industry.

EXPECTATION TO THE NUCLEAR POWER GENERATION

Tsunenori Yamaguchi
Chairman and Director
Shikoku Electric Power Co., Inc.
Japan

Nuclear power plants in Japan have now become, with the improvement of load factors, the alternative source of energy producing nation's 20% electricity. And now it is said that light water reactors have secured a core position as a source of electric power.

In securing future energy source of our country dependence on the LWRs would be an inevitable course of action for a considerably long period of time from now on. Further new developments of LWRs, therefore, are much expected for.

But before this expectation is to be answered, not only nuclear reactor but also nuclear fuel cycle must take firmer root in the industry.

I wish to present my personal views regarding the problems we should tackle from now on, reflecting the history of the development of nuclear power in Japan.

INPO AND THE VITALIZATION OF THE NUCLEAR INDUSTRY

E.P. Wilkinson
President
Institute of Nuclear Power Operations
U.S.A.

In recent years, leaders of the U.S. nuclear utility industry have taken many steps to improve the safety, reliability and overall quality of nuclear plant operations. These actions were initiated as a result of questions raised by the 1979 Three Mile Island Nuclear Plant accident, concerns about nuclear construction quality, and an overall recognition that compliance with regulations alone does not ensure the best possible performance.

As part of its actions, the industry formed the Institute of Nuclear Power Operations (INPO). INPO's goal is to support the utilities' drive for improvement of construction quality and operational safety and reliability. INPO maintains many programs to meet this goal.

One of these is an active International Program. It was established in 1981 to provide the foundation for a worldwide pool of nuclear expertise and experience. Japan's nuclear utilities are represented in the program by CRIEPI. Through CRIEPI, Japan has made many contributions to INPO and to the International Program. These include lending an engineer to the International Liaison Engineer Program for two years. The engineer shares his experience with INPO by actively working in its programs, plus he has the opportunity to observe U.S. utility operations.

CRIEPI also contributes to INPO's Significant Event Evaluation and Information Network (SEE-IN). SEE-IN performs a function similar to Japan's Nuclear

Information Center. SEE-IN provides for screening, analyzing and sharing information about operating experience at INPO members' and participants' nuclear plants. Utilities use this information to improve operations and to avoid recurrences of potentially significant operating events.

CRIEPI is also an active user of the NUCLEAR NETWORK. NETWORK is a computer-based telecommunications system that links INPO's member and participants. Utilities use NETWORK to share information about operating practices and problems and to pose questions to the worldwide nuclear community.

In recent years, many utilities have developed and improved systematic performance-based training programs for their nuclear plant personnel. INPO supports these efforts with a number of programs, and CRIEPI receives the material developed for these programs.

CRIEPI also receives documents produced for INPO's assistance to utilities in the areas of radiological protection, chemistry and emergency preparedness.

INPO performs evaluations at operating nuclear plants and plants under construction in the United States. Resources permitting, INPO will provide teams by request to examine specific aspects of non-U.S. utilities and plants.

INPO is committed to high construction quality and safe and reliable plant operations on a worldwide basis. INPO stands ready to assist and to learn from our Japanese participants to achieve our mutual goals.

THE OPERATING EXPERIENCE OF FRENCH PWR

B. Meclot
Chef de Division au
Electricite de France
UNIPEDE

In 1970 France started a major electro-nuclear development program which involved commissioning 27 "900 MW PWR" units between 1977 and 1983 of which four in 1983.

This 25,000 MW produced 126 TWh in 1983, which corresponded to a 49 percent share of total thermal production from E. d. F. At the end of 1983, the 27 units have been operated equivalent 82 reactor-years, and 46 shutdowns for refueling and annual inspection.

The operating experience gained allows a representative overview of the reliability of these units to be established, in particular regarding their availability ratio, which is satisfactory by comparison with the results shown in international statistics.

By implementing a complex system of feed back of experience, it has been possible to draw full benefit from the effects of producing. In series, and to take advantage of the teachings flowing from events affecting safety, maintenance programs have also been refined in the same framework and experiments are, at present, in progress to increase the reactor cycle duration.

The major contribution of nuclear power to the French generation system is the participation of these units in daily load modulation. As during summer 1983, the use of a new mode of reactor operation has revealed the considerable operating flexibility achieved on the network.

NUCLEAR COMPONENT SUPPLIER – PROSPECTS AND IMPOSED TASKS –

Soichiro Suenaga
President
Mitsubishi Heavy Industries, Ltd.
Japan

1. Introduction

Although there is every indication that the size of nuclear market initially predicted for Japan will be and has to be reduced, the leadership asked for nuclear technology is unchanged but today sought even stronger, nuclear power, particularly the LWR, not only to demonstrate itself its ever improved performance, is now expected to assure the best economical source of energy supply with the reduced construction cost.

The speaker, representing the nuclear plant suppliers, will delinaeate the prospects and tasks that the nuclear component industry views today.

2. Familiarization to Sophistication of LWR Improved Performance

The history of nuclear power in Japan started with import of basic technologies, but quickly domesticated such technologies of foreign origin, and has been on improvement for matching with the environment in Japan.

In anticipation of utilities requirements for future, advanced versions of LWRs are being developed thus the phase of nuclear power, in history, could well be for maturity after reaching the period of familiarization. Familiarization is one step of process necessary in introducing a technical system into public.

The speaker prospects the LWR suppliers' challenge for future technologies, the new level of optimization of LWR, by reviewing the history of LWR in Japan, focused on PWR, with the following items:

(1) familiarization of LWR

(2) sophisticating the LWR improved performance

(3) developing the advanced LWRs.

3. Nuclear Plant/Component Export

Exporting the nuclear plant/component will play an important role in areas of refining the structure of export industries of Japan, contributing to giving a stable market basis for nuclear industry, and cooperating with the aims of developing countries for peaceful application of nuclear power.

The plant suppliers' view point, however, is rather conservative not to jump at hastily the creation of exporting systems but to counter with each specific requirements of need countries.

The speaker will summarize such suppliers' view with respect to the following points:

(1) tasks imposed today to clear for exporting nuclear power plant components.

(2) coping with future demand.

4. Conclusion

In providing "new optimization" for a LWR power plant, the plant supplier has the responsibility to public for it's supply of products and such responsibility could well be fulfilled under the guidance of government administration and power utility companies. For refining the present systems to reach a new level of optimization a supplier's effort could be a major contribution to the technical area of design, manufacture, construction at site and operation and maintenance services, whereas for measures of reduced construction cost, etc. any effort would have to be predicated on a levelized and constant number of contract awarded to the supplier.

The "new optimization" effort sees many hurdles yet to clear before any input for desirable optimization could be set, highest of which being the public acceptance. The suppliers hope that a nuclear project will in future be smoothly executed as planned.

The speaker will rely on another opportunity for discussing development policies of advanced nuclear concept, relaying LWR to FBR then further to CTR.

With respect to the backend development of fuel cycle technologies, the speaker sees it clear that backend is the most crucial for Japan today and is assured that the suppliers are to cooperate with any decisions that power utilities will make under the guidance of government administrations.

This subject will be discussed at the separate session of this conference.

NUCLEAR POWER AS VIEWED FROM CONSTRUCTION STANDPOINT

Yorihiko Osaki
Executive Vice President
Shimizu Construction Co., Ltd.
Japan

In recent years Japan is proud of high and stable operating performance of nuclear power plants. This is regarded as a sign that LWR (light water reactor) technology has reached the stage of maturity. However there is a tendency of the gradual escalation in generating cost of nuclear power. It is feared, therefore, that its cost advantage over thermal power might be impaired in the near future, unless some proper peasures are taken.

This higher cost is primarily attributed to the continuing escalation in construction cost. Last year the Advisory Group for Improvement of Nuclear Power suggested in its recommendation the basic measures to improve the economy of nuclear power. In order for the nuclear industry to cope with the recent difficult circumstance of slow growth, it is imperative to study the remedial measures and apply them to actual nuclear power plant design and construction.

It is obvious that the high construction cost be essentially attributable to the two key factors; bulky material and lengthy construction. In order to tackle the insure of construction cost reduction, the auther would like to propose that the improvement be made in three steps as follows;

Phase I	:	Follow the currect regulatory requirements and practices
Phase II	:	Basically follow the current regulatory requirements with correct interpretation and rationalization of practices
Phase III	:	Amend some of the regulatory requirements in view of latest knowledge

A preliminary study indicates that fairly good improvements be achievable even under the phase I conditions, owing to the recent development in analytical methods and construction experiences.

For the phase II and III review, it is required to show some valid evidences to verify the adequacy of proposed improvements. But it is my belief that this can be accomplished thanks to the latest knowledge and accumulation of data. The auther would like to take this opportunity to ask for a cooperative effort among the parties possessing valuable data so that a joint study could lead to successful substantiation of proposals.

The ongoing effort for LWR Improvement and Standardization is also effective in reducing the construction cost. Additionally a further effort must be made to promote research and development to improve the economy of nuclear power.

Needless to say, what is essential in the development of nuclear power is to keep good balance of safety, reliability and economy. For the nuclear power to play a continuing key role in electricity supply in Japan, it is the most important and urgent task these days to do our best in enhancing the economy of nuclear power without imposing any penalty on the safety of nuclear power plants.

Wednesday 14 March

2:30 pm - 5:30 pm

SESSION 3 DEVELOPMENT STRATEGY OF THE BACK-END OF NUCLEAR FUEL CYCLE (Panel Discussion)

There are two sides to the back-end of the nuclear fuel cycle - management of high level radioactive waste and production of new energy sources, plutonium. For the management and disposal of rad-waste, it is time now to specify concrete measures from a long-term point of view. On the other hand, prospects for the full-scale utilization of plutonium are dim, because of delays in the commercialization of fast breeder reactors. We are pursuing a policy of reprocessing to make use of recovered uranium and plutonium, disposing of high level radioactive waste by solidification and storage. In view of the new situation mentioned, it seems important to give consideration to this policy from a long-term point of view. Countries will explain their back-end policies and developments and their plutonium utilization programs, to provide material for a comprehensive study of back-end development strategy.

DEVELOPMENT STRATEGY OF THE BACK-END OF THE NUCLEAR FUEL CYCLE

Sidney M. Stoller
Chairman
The S. M. Stoller Corporation
U.S.A.

This paper will try to provide some perspective on the history of back-end development. Hopefully, this will serve as a useful backdrop for the panel discussion, and as well, such a review of the experience of others should be helpful to Japan in its current review of back-end strategy.

The text is basically a retrospective view of the U.S. experience which, although elements are clearly unique, generally covers events and influences which were global in impact. The paper nominates seven factors which have been of major influence to the path of back-end developments. The strength of these influences have changed over time with changing conditions, and a subjective attempt is made to quantify those changes.

It is clear that extraordinary transformations of attitude and climate have taken place in this field in the U.S. in the past two decades. To see patterns in this transformation, it is necessary to break down the history into discrete periods. The paper suggests that it is useful to characterize these into three distinct phases. The first, called The Era of Great Expectations, occupied the period from the beginning of the 1960's to the early 1970's. The second, designated as an Interval of Constraint, covers the years during the mid- and late 1970's. The third, entitled the Era of Retrenchment and Uncertainty, started in the late 1970's, and persists today. The paper addresses each of these phases in turn, and goes on to offer a view of what may lie ahead in the U.S.

Against that background, the paper turns to the question of what relevance, if any, the U.S. experience has to the back-end activities and planning of other nations with major commitments to nuclear power - - in particular, Japan. Anticipating the insights and information to be presented by the other nations represented on the Panel, the paper recommends an agenda for the discussion among the panel members which will follow the presentations, and suggests those particular Japanese circumstances which must necessarily be taken into account.

– KEYNOTE –

Calude F. J. Ayçoberry
Directeur de la Branche Retraintement
COGEMA
France

The technology for reprocessing of light water fuels has come of age industrially. This is particularly demonstrated by the results achieved at the la Hague facility, both for production performance and for safety.

On the basis of this demonstrated technology, an expansion project was launched to increase la Hague's reprocessing capacity to 1,600 tons of spent LWR fuel per year. Information is provided on the features of the new plants and their construction progress.

Considering the plans for present and future plants, including through in the United Kingdom and WA ‿50 in the Federal Republic of Germany, the quantity of plutonium which will be available in Europe and especially in France, particularly during the 1990's, is evaluated. Given the quantity necessary to fuel breeder reactors under construction of on order, it appears there will be substantial plutonium availability. The advantage of its use in the form of mixed oxide LWR is shown, particularly from an economic standpoint. French projects in this area are highlighted.

The conclusion evookes the advantage of a global approach to the problem of closing the nuclear fuel cycle.

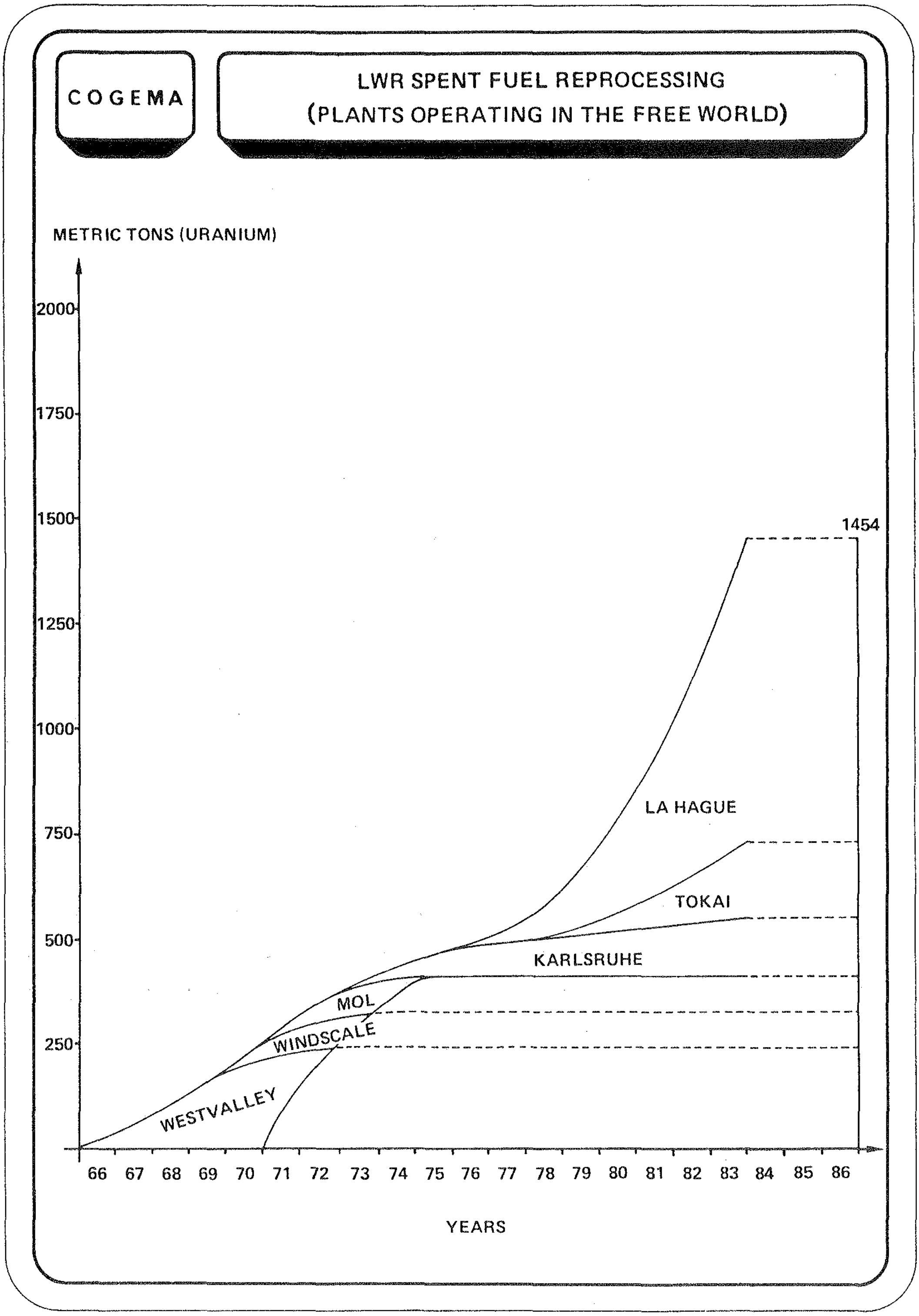
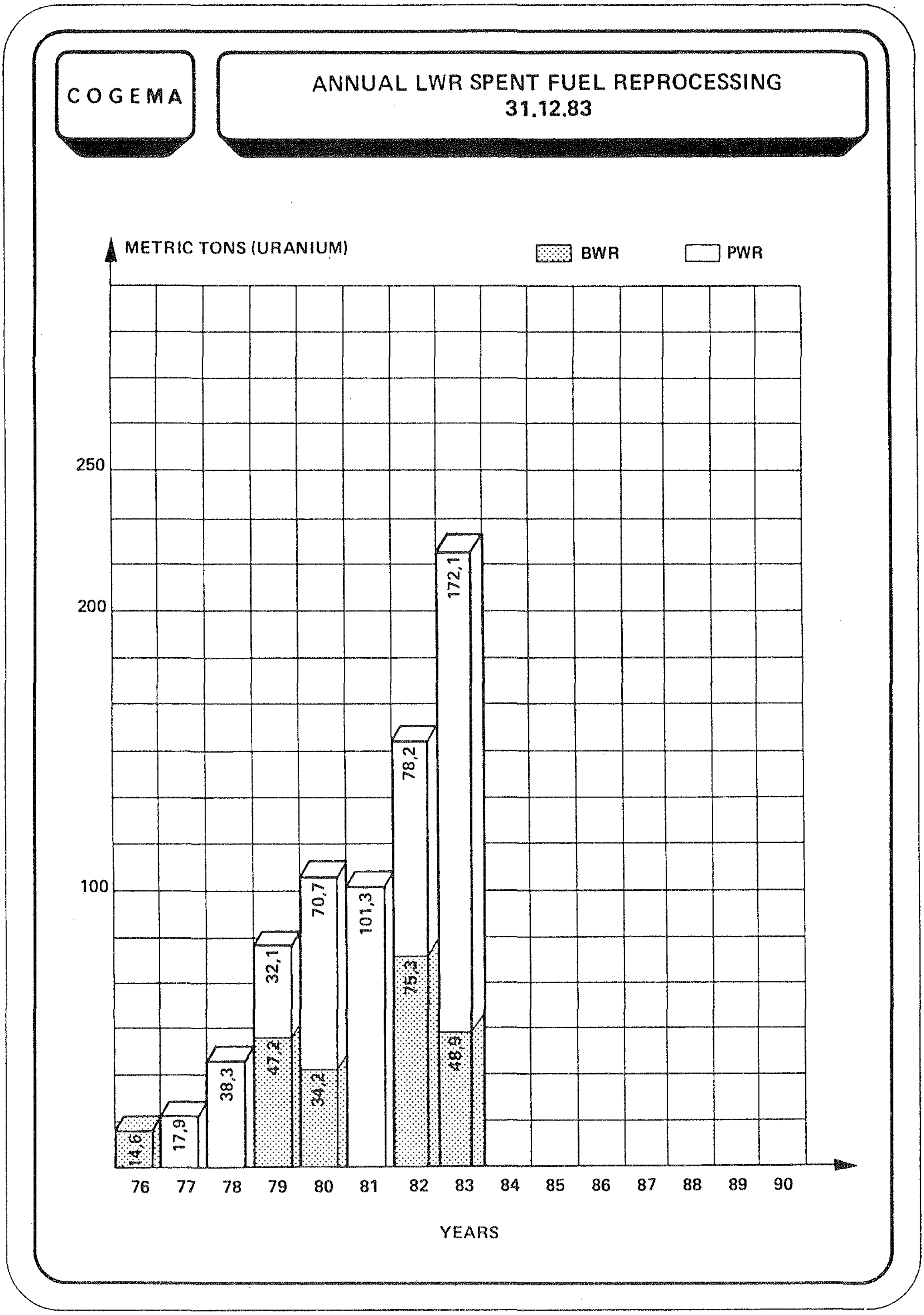
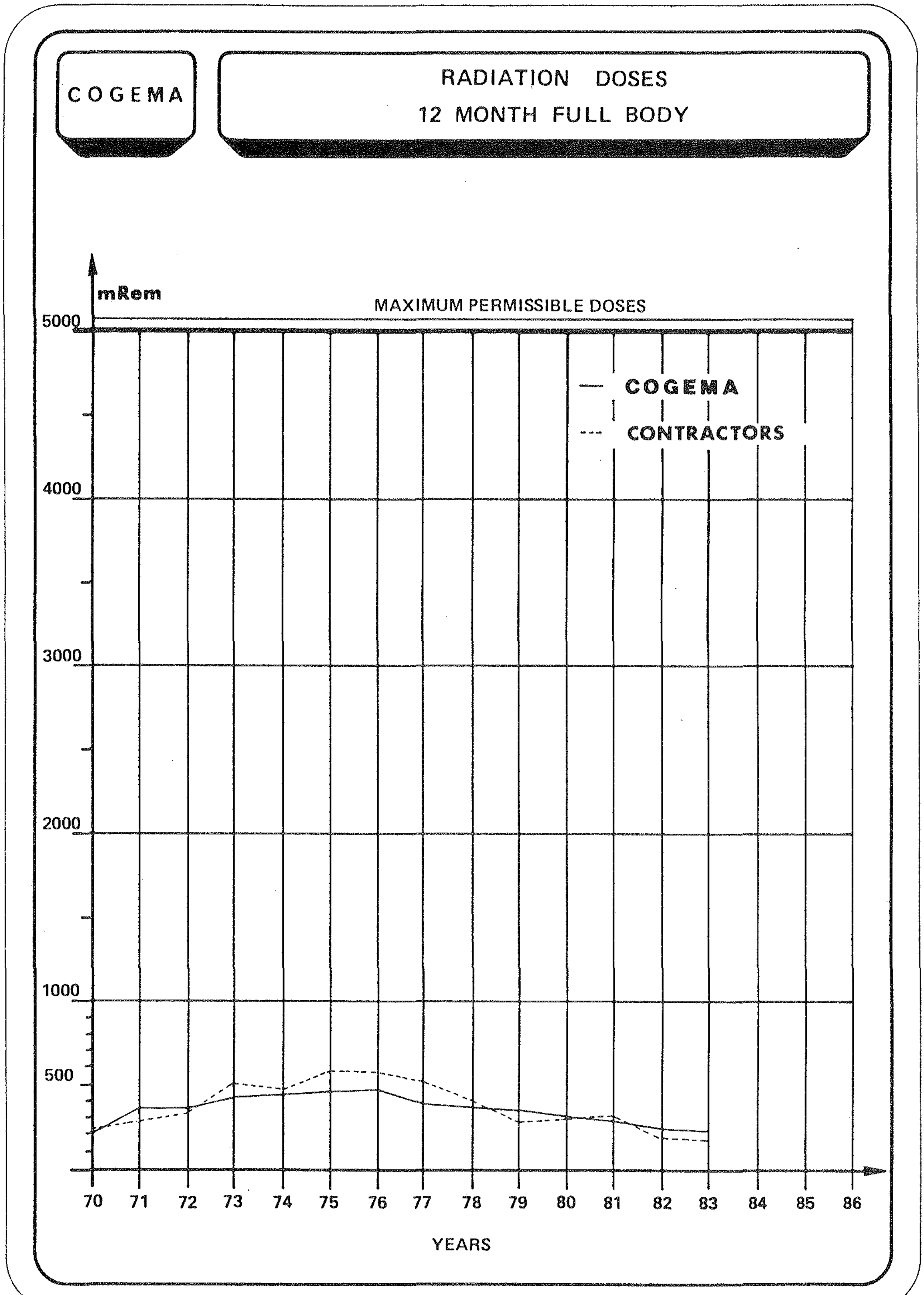

COGEMA
LWR SPENT FUEL REPROCESSING
(PLANTS OPERATING IN THE FREE WORLD)
METRIC TONS (URANIUM)
2000
1750
1500
1250
1000
750
500
250
1454
LA HAGUE
TOKAI
KARLSRUHE
MOL
WINDSCALE
WESTVALLEY
66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
YEARS

Figure N° 1



COGEMA
ANNUAL LWR SPENT FUEL REPROCESSING
31.12.83
METRIC TONS (URANIUM)
BWR
PWR
250
200
100
14,6
17,9
38,3
47,2
32,1
34,2
70,7
101,3
75,3
78,2
48,9
172,1
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
YEARS

Figure N° 2



COGEMA
RADIATION DOSES
12 MONTH FULL BODY
mRem
MAXIMUM PERMISSIBLE DOSES
5000
4000
3000
2000
1000
500
— COGEMA
--- CONTRACTORS
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
YEARS

Figure N° 3

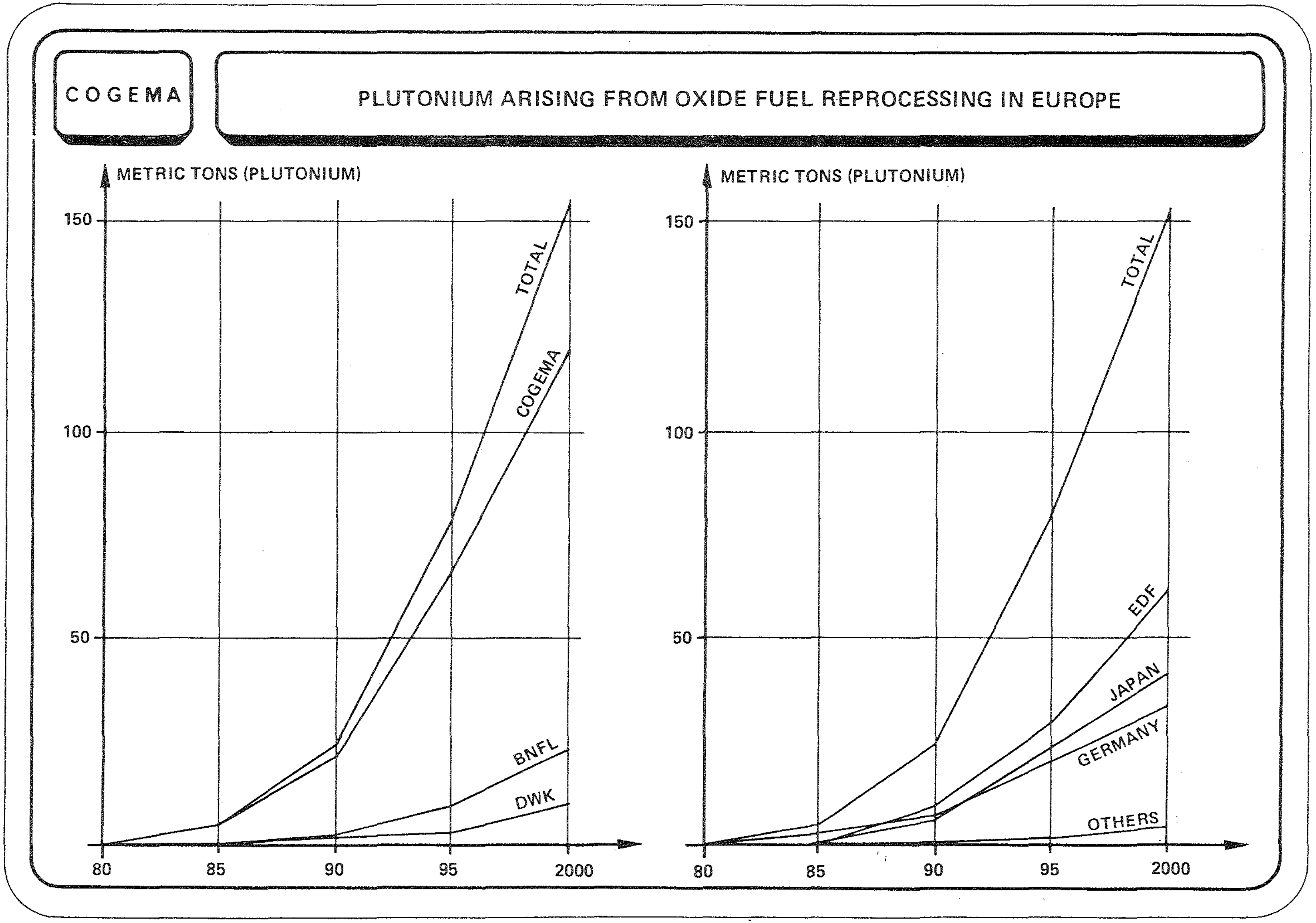

COGEMA
PLUTONIUM ARISING FROM OXIDE FUEL REPROCESSING IN EUROPE
METRIC TONS (PLUTONIUM)
150
100
50
TOTAL
COGEMA
BNFL
DWK
80
85
90
95
2000
METRIC TONS (PLUTONIUM)
150
100
50
TOTAL
EDF
JAPAN
GERMANY
OTHERS
80
85
90
95
2000

Figure N° 4

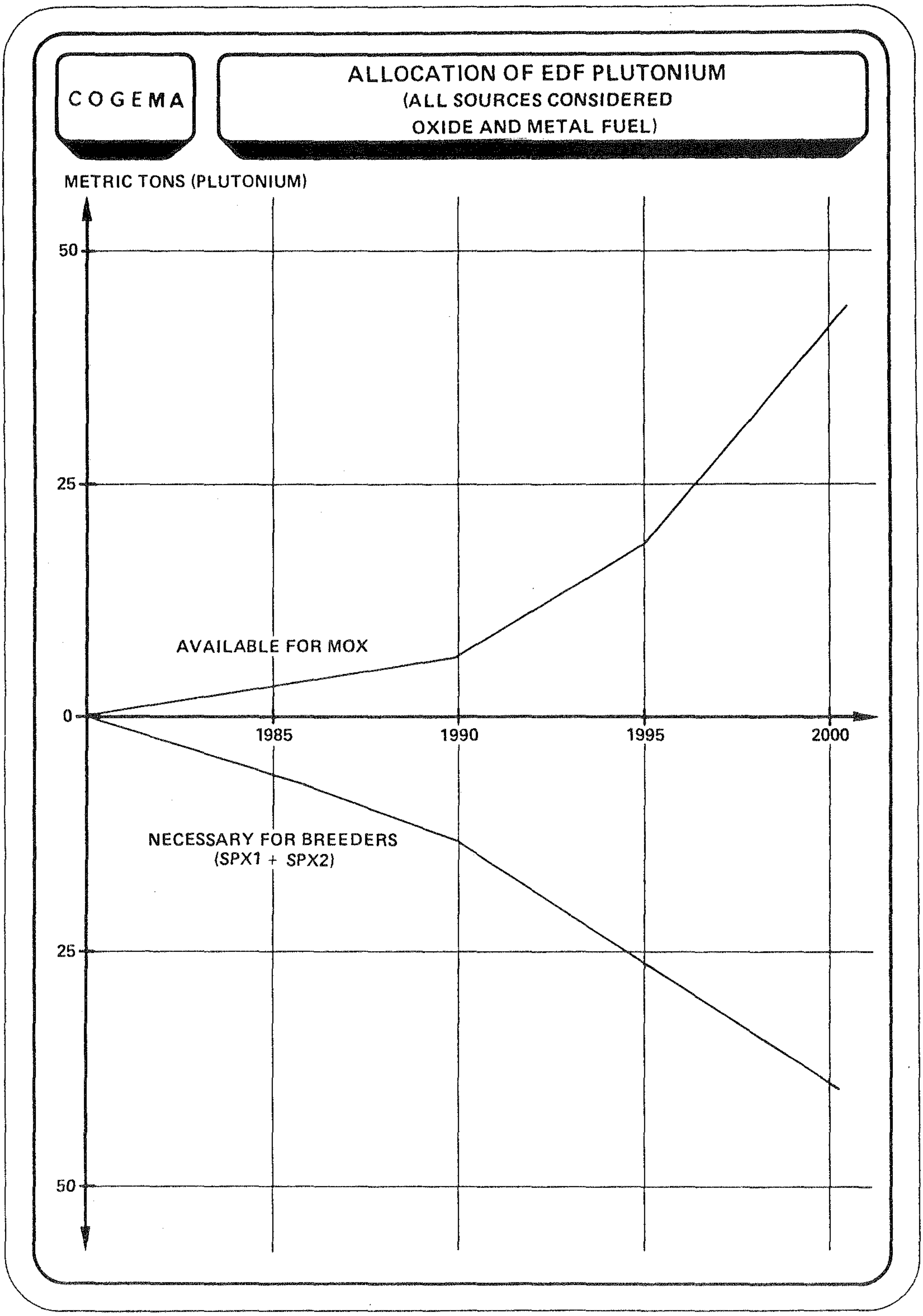

COGEMA
ALLOCATION OF EDF PLUTONIUM
(ALL SOURCES CONSIDERED
OXIDE AND METAL FUEL)
METRIC TONS (PLUTONIUM)
50
25
0
25
50
1985
1990
1995
2000
AVAILABLE FOR MOX
NECESSARY FOR BREEDERS
(SPX1 + SPX2)

Figure N° 5

THE BACK-END OF THE NUCLEAR FUEL-CYCLE IN THE FEDERAL REPUBLIC OF GERMANY

K. Janberg
GNS Gesellschaft für Nuklear-Service mbH
F. R. Germany

In Germany the first 1,500 t dry cask storage facility at Gorleben has been licensed for a 40 years operating time in September 1983 and its construction has been finished in December. A supplementary 1,500 t facility at Ahaus of the same design has received its construction permit in October 1983.

Furthermore licensing application for a 350 t U/a reprocessing plant have been filed for the two sites of Wackersdorf (Bavaria) and Dragahn (Lower Saxony).

The public hearings herefore have taken place in February 1984 and the applicant, DWK, a utility subsidiary, expects the license to be issued either in 1984 or 1985.

In parallel to these activities extensive and intensive studies have been made upon request of the German Government with respect to the safety aspects of direct final disposal of spent fuel. The results will be presented to Parliament in May this year and as we hear from DWK, the preliminary results seem to indicate the feasibility of this alternate solution and even an important economic advantage compared to reprocessing.

The other problem area is the disposal of the wastes from reprocessing. Herefore a salt mine has been defined, but its suitability is not yet definitely proven.

What we know for sure so far is that the cost estimates made herefore several years ago have to be adjusted upwards. As the commercial introduction of the fast breeder seems to be delayed beyond the turn of the century, it is mainly a political decision, if reprocessing comes out as the reference solution for the short term.

However, so far the governmental institutions and the utilities have clearly indicated their intention to go the reprocessing route, even if short term economics favour the alternate solution.

STATUS OF BACK END FUEL CYCLE DEVELOPMENT IN THE UNITED STATES

Kermit O. Laughon
Director
Office of Spent Fuel Management and Reprocessing Systems
U.S. Department of Energy
U.S.A.

At the present time there are no active efforts to develop commercial reprocessing capabilities for Light Water Reactor fuels in the United States. This presentation will review developments during recent years regarding commercial reprocessing, including those related to the Barnwell Nuclear Fuel Plant. The incentives, disincentives, and uncertainties associated with reprocessing will be discussed briefly in the context of the present status of commercial nuclear power in the United States and Government policy.

With the passage of the Nuclear Waste Policy Act of 1982, the United States is committed to establishing nuclear waste disposal facilities for high level nuclear wastes or unreprocessed spent fuel. The program is now in place, nuclear utilities are providing funding, and the U.S. Government is committed to accept spent fuel from power reactors beginning in 1998. Some of the major activities which are being conducted under the nuclear waste program will be discussed briefly as will the current situation and future outlook for spent fuel storage from existing power reactors in the United States.

With the cancellation of the Clinch River Breeder Program, the United States has clearly delayed the schedule for commercial breeder development and deployment. Nevertheless, a strong breeder development program is continuing, with some changes, in emphasis which will be reviewed briefly. In particular, the continuing efforts on breeder fuel cycle technology will be described.

TABLE 1

BARNWELL DOE-SUPPORTED R&D ACCOMPLISHMENTS

- Safeguards
  - Material Accountability System

    Near Real Time Monitoring and Accounting for All Special Nuclear Material in the Facility
  - Safeguards System

    Hands-on Training of Domestic and International Personnel

- Fuel Reprocessing
  - Flowsheets and Laboratory Studies on Alternate Methods for Processing Uranium Fuel
  - Conceptual Design for Coprocessing Uranium-based Fuel

    Updated Overall Site Plan

    Cost Estimates for Additional Facilities
  - Design of Head-end to Enable Reprocessing of Breeder Fuels

- Spent Fuel Storage and Transportation
  - Efficient Methods of Handling Spent Fuel
  - Assessment of Existing Fleet of Shipping Casks
  - Conceptual Design of Equipment and Servicing Facilities for Maintenance of Shipping Casks
  - Fuel Disassembly as a Means of Consolidating Fuel

TABLE 2

PROGRAM GOALS OF WASTE PROJECT

- o Site, design, construct, and operate one or more mined geologic repositories by January 31, 1998
- o Design and site an engineered Monitored Retrievable Storage Facility, on a schedule that will permit its timely construction, should the Congress determine such a facility is needed
- o Assist utilities in providing adequate, safe at-reactor storage of spent fuel prior to Federal acceptance and stand ready to deploy limited Federal Government storage to utilities on an interim basis, if they are determined qualified by the Nuclear Regulatory Commission
- o Manage the technical program and the funds collected for disposal and storage services in an efficient manner

TABLE 3

ACCOMPLISHED TASKS UNDER THE NUCLEAR WASTE POLICY ACT

- Identification of nine potentially acceptable sites for the first repository in six states:

Louisiana	Mississippi
Texas	Nevada
Utah	Washington

- Establishment of fee collection and payment procedures for financing the full-cost recovery program

- Closure of contracts with nuclear utilities for disposal services

- Submittal to Congress of a report describing research and development needed to develop a proposal for a monitored retrievable storage facility

- Selection of three utilities to conduct cooperative demonstrations for storage of spent nuclear fuel

Dry Storage:	Virginia Electric and Power Company Carolina Power and Light Company
Rod Consolidation:	Northeast Utilities Service Company

TABLE 4

GOVERNMENT BREEDER PROGRAM GOALS

Overall Objective:

- To develop the technology for a safe, reliable, and marketable reactor that is competitive with alternative energy sources

Program Goals:

- Competitive system economics, including reasonable and reliable schedules
- Improved safety through exploitation of inherent capabilities
- Ability to respond to market requirements
- Resilience to regulatory processes
- Improved fuel cycle technology

TABLE 5

BREEDER REPROCESSING ACCOMPLISHMENTS

- Integrated Equipment Test Facility for Cold Testing
  - Rotary Fuel Dissolver
  - Centrifugal Solvent Extraction Contactor
  - Automatic In-cell Process Sampler
  - Laser Cutting Component of Disassembly Machine
  - Prototype Process Equipment Module
  - Remote Servomanipulator

- Breeder Reprocessing Engineering Test (BRET)
  - Preliminary Design Completed
  - Design Based on Installation in Fuels and Materials Examination Facility
  - Enables Closing Fuel Cycle-Demonstrates Fuel Cycle Park Concept

- Demonstration Scale Breeder Reprocessing
  - Conceptual Design and Cost Estimate of Hot Experimental Facility

- Technology Exchange Agreements
  - Japan: Remote Technology and Criticality Measurements
  - United Kingdom: General Technology

– KEYNOTE –

Sir Walter Marshall
Chairman
Central Electricity Generating Board
United Kingdom

The Work on the back-end of the fuel cycle has developed diffently in the United Kingdom compared to other countries. This is because the British launched their civil nuclear power programme with gas cooled reactors which demand re-processing because the spent fuel cannot conveniently be stored for a long time.

This means that the public debate in the United Kingdom has focussed on the necessity to vitrify fission product waste and demonstrate the safe disposal of waste in geological formations. We have alsways planned to use the plutonium in fast reactors and that remains true although the timescale for that is much later then at one time we thought. Thinking on all these matters has evolved with our experience of the nuclear power programme and this evolution of discussion and of policy will be described as it has evolved in the past and as it stands today.

[Session – 3]

DEVELOPMENT STRATEGY OF NUCLEAR FUEL CYCLE BACKEND

Masatoshi Toyota
Managing Director
Tokyo Electric Power Company, Inc.
Japan

Ladies and gentlemen, I would like to talk briefly today about the backend of the nuclear fuel cycle in Japan, describing the present situation and touching on some related problems.

Let me begin with the reprocessing of spent nuclear fuel. Since Japan is poor in uranium resources, Japan's basic policy should be to reprocess spent nuclear fuel and to recycle the plutonium recovered. This plutonium is to be used as fuel in fast-breeder reactors, which have a high burn-up efficiency.

About 70% of the spent fuel generated in Japan up to 1990 will be processed at the Tokai plant of the Power Reactor and Nuclear Fuel Development Corporation, the only reprocessing plant in Japan, and at plants in the United Kingdom and France.

For spent fuel generated after 1990, processing in Japan is being planned. To this end, electric power companies, plant manufacturers, trading companies, and other companies concerned in the field have established a new company, Japan Nuclear Fuel Service Inc., which is making preparations for the construction of a second fuel reprocessing plant in Japan.

According to recent OECD and IAEA figures on uranium resources, confirmed and estimated deposits of uranium in the free world total about 8 million tons.

Even if recovered plutonium and uranium were not recycled, there are sufficient natural resources to supply the necessary quantity of uranium until the middle of the 21st century. It will be a long time before FBRs can compete with LWRs as far as cost is concerned, depsite active research and development programs leading towards commercialization. Therefore, it is anticipated that LWRs will play a primary role in nuclear power for the next forty to fifty years.

I should like to turn now to reprocessing technology. Although the Tokai plant has a capacity of 140 tons per year based on 200 operating days per year, the total quantity of fuel reprocessed since September 1977 is only 170 tons, which means that the plant is in fact processing a maximum annual quantity of 55 tons at present. Therefore, it is necessary to improve the reliability of this facility. There are strict requirements for safety control in Japan, and consequently, in order to obtain a better capacity factor, more efforts need to be made in the area of technical developments.

Also, the cost of reprocessing has been higher than expected and currently is from 150 million yen to 200 million yen per ton. And it is anticipated that costs will become even higher because of the vital importance of environmental considerations in Japan. Therefore, rationalization of regulatory requirements and research and development to keep costs at a minimum are indispensable.

In addition, the nuclear non-proliferation policy of the U.S. has affected Japan from using plutonium on a commercial scale so that commercialization of plutonium recycle in LWRs has become more difficult and hard to predict the time of its commercialization.

Under these circumstances, review of the nuclear fuel cycle backend is now being carried out. Final results of these efforts are not yet available, but I should like to give you my personal views on the matter.

I believe that for future reprocessing in Japan, reliability and economy are the two basic considerations.

Specifically, JNFS needs to actively promote the siting of the second reprocessing plant in Japan. Once it appears likely that a suitable site will be available, JNFS should make preparations for a spent-fuel pool at the facility and a storage facility for returned radioactive waste from the U.K. and France so that construction of these facilities can be begun as soon as possible.

For construction of the second reprocessing plant, technical development should be vigorously pursued, aiming at reliability and cost effectiveness. At the same time, we must make approaches to the regulatory bodies concerned to convince them of the need to rationalize regulatory controls so that we shall be able to forecast reliability and cost effectiveness.

In the design of the second reprocessing plant, even if we obtain the cooperation of other countries in the area of systems engineering, I believe it would be most appropriate for us to design and manufacture the system using domestic technology. However, in order to do so, it is necessary for us to organize the manufacturers in Japan into a working group.

Moreover, since it appears that the commercialization of the FBR will take longer than had been expected, we must face the fact that plutonium recovered from reprocessing will have to be recycled in light water reactors.

Therefore, further development work on the use of plutonium in LWRs needs be done, and it is necessary for us to work towards an international concensus on the commercialization of recycled plutonium in LWRs.

I should like to turn now to the problem of the interim storage of spent fuel. The world's reprocessing plants have small capacities and low plant factors so that it will be possible to process some that less than half of the spent fuel generated by 2000. The balance, therefore, will have to be stored somewhere else. It is necessary to decrease the radioactivity of nuclear fuel after extraction from the fuel core to facilitate reprocessing and improve cost efficiency. For that purpose, spent fuel will be stored for three to seven years after unloading and then will be reprocessed. In building additional reprocessing facilities, it is necessary to take this storage period into consideration.

There are various possibilities available for interim storage, including dry casks, water pools and vaults. We think it is most economical for quantities of fuel up to 3,000 tons to be stored in dry casks, for quantities over 3,000 tons, storage in pools is most cost efficient.

Finally, I would like to say a little about the management and disposal of high-level radioactive waste generated in reprocessing.

Management and disposal of high-level waste is so important that in Japan the government has taken responsibility for disposal.

Of course, this disposal will not become necessary for another forty years or more. However, it is necessary at this time to set up a plan or rough schedule for the development of disposal capacity in order to reassure the general public and obtain their support for the further development of nuclear power.

According to the government's present plan, a site is to be selected for the construction of a test disposal facility by 1995, and after thorough testing, test operation is to being by 2015. However, in order to obtain the public's support for nuclear power development, it is necessary to expedite this plan and develop comprehensive plans for large-scale disposal.

Despite all of the difficulties I have touched on today concerning the nuclear fuel cycle backend, we shall make every effort to overcome these problems through international cooperation with the combined efforts of the public and private sectors.

Thank you.

– KEYNOTE –

Kunihiko Uematsu
Executive Director
Power Reactor and Nuclear Fuel Development Corporation
Japan

In the Japanese nuclear long term Research and Development Program which was set up by Japan Atomic Energy Commission in 1982, it is clearly stated that the maximum effective utilization of plutonium and uranium recovered from the reprocessing operation is the basic and vital policy of Japan. In doing so, Japan can realize the reduction of dependence on the foreign resources for the supply of our vitally needed energy.

Currently, world economy is in the state of recession compared with years ago, and the requirement on energy supply is so reduced. At the same time, the abundance of natural uranium on the market is much more than the current and near future requirements of LWRs. Even though natural uranium is flourishing, unless having such uranium as a purchased goods under Japanese total control, the security of energy supply in Japan can never be increased. Therefore, Japanese basic policy to make maximum use of plutonium and uranium recovered from reprocessing has never changed even with considering the current nuclear market situation.

Based on such basic policy, PNC has developed and proved the technology of using plutonium and recovered uranium in fast and advanced thermal reactors (ATR) in parallel with the research effort to realize the plutonium LWR recycling. It can be said that the technologies to use MOX fuel are now in existence in Japan and it is becoming very close to the commercial stage.

However, the supply demand gap of plutonium and uranium from reprocessing operation in Japan is large. Firmly committed fast and advanced thermal reactors requirement can not be met in near future, unless the early realization of the second Japanese reprocessing plant operation is achieved.

PNC have learned a lot from our bitter and hard operational experiences of Tokai Reprocessing Plant. Because of such experiences, PNC and industries under the support of Japanese Government have conducted considerable development works in order to realize the second Japanese reprocessing plant as soon as possible. It is safe to be said that the PNC's experience, base technologies and supporting industrial powers are already in existence in Japan to start the second reprocessing plant with having the cooperation of experienced countries. It is our strategy to do so in order to meet the afore-mentioned Japanese policy.

Thursday 15 March

9:30 am - 12:30 pm

SESSION 4 A NEW STAGE OF INTERNATIONAL COOPERATION IN NUCLEAR ENERGY (Panel Discussion)

In order to secure future energy supplies, the need for nuclear energy development in Asian countries is increasing. Most of the Asian countries are making concrete plans for nuclear energy development; many already positively promote nuclear power. The countries which are in the early stages of nuclear power development request assistance from the advanced industrialized countries and international organizations such as the IAEA, so that their programs will have a sound and steady development. Such cooperation and assistance has become more and more important. In this session, we will deal with the broad aspects of future international cooperation as follows: (1) Review the experience in cooperation and technology transfer between the IAEA or countries with advanced technology, and the countries developing technologies. (2) Learn what cooperation is actually needed by countries with developing technologies. (3) Determine the role that the IAEA and the countries with advanced technologies can play in giving technical assistances and cooperation. (4) Look for a way to promote cooperation in nuclear energy in the Asian region.

FUTURE PROBLEMS OF INTERNATIONAL COOPERATION

Takehisa Shimamura
Commissioner
Atomic Energy Commission

(1) None of the numerous world nations, large and small, can get by without international cooperation. Of course, international cooperation is available in a variety of forms – global and regional cooperation, multilateral and bilateral co-operation, political cooperation, military cooperation, economic cooperation, technical cooperation, and so on. When seen in terms of atomic energy, in particular, what is international cooperation? What is the reason why this must be taken up separately from the other categories of cooperation? Perhaps, needless to say, that is due to the peculiar character that radioactivity has. Atomic energy was first used, unfortunately in the form of an atomic bomb – the military use of atomic energy which could lead to ruin for mankind and which could not be prevented from being repeated without international cooperation. Secondly, using this huge potential of atomic energy for purposes of mankinds's prosperity and well-being is a lofty ideal which cannot be realized without international co-operation. Atomic energy is still a new field of study in which knowledge and experience vary widely from country to country. Besides, as it involves the treatment of radioactive material, approaches need to be made on a large scale. Countries setting out on their own separately for the development of atomic energy, it will bring nothing and get nowhere. That is not all. The Three Mile Island power station accident of 1979 in the United States shock the world although it involved no casualties. In Japan, it not only forced a shutdown on all PWR type reactors for inspection, but also dealt a serious blow to the siting of new nuclear power facilities. The point is that the use of atomic energy cannot be a task for any one country alone to tackle, but must be undertaken by international cooperation as a task common to all countries. The need of international cooperation in atomic energy will go on increasing.

(2) A firm resolution was needed for Japan, the only country to have been atom-bombed in the world, to embark on the research and development of atomic energy. A law was established to declare a principle of restricting the use of atomic energy to peaceful purposes. The Atomic Energy Basic Law also stipulated a basic policy of "making achievements openly available to help promote international cooperation." This is the stance of Japan. The 30 years that have passed since then were needed for Japan to reach the world level and come to the attention of the world. This results from the research investments and efforts that the Japanese have made for themselves, but it could not have been achieved without the cooperation of the more developed countries. First, young Japanese scientists and engineers were sent abroad for study at the foreign universities and research institutes where they could build up their knowledge. Private industries sought to introduce technology from their countrerparts in the more developed countries. Machinery was also imported to provide for the development of reactors. For all its supplies of uranium resources and uranium enrichment services, Japan still depends on foreign countries. But is this the form of international cooperation that was envisaged in the Atomic Energy Basic Law? Is it anything more than just getting what Japan needs with the cooperation of other countries? The opinion is gaining ground that Japan should extend cooperation, as might be expected from its position now, to other world nations, especially those going the way that Japan has once passed.

Of course, it is not that Japan has so far done nothing worthy to be described as international cooperation. This country joined International Atomic Energy Agency in 1956. In 1959, it made a purchase of Canadian natural uranium through the medium the Agency to become the first nation to come under the application of the Agency's safeguards. Since then, we have invariably joined in IAEA activities to support the encouragement of peaceful uses of atomic energy. We joined ENEA (now NEA), too. Although some Japanese objected to NPT regarding it as an unequal treaty, we acceded to it on the strength of its provisions against vertical, as well as horizontal, proliferation of nuclear weapons. We are ready to accept the Agency's full scope safeguards and are cooperating with this organization in developing safeguards technology. Nuclear fusion and fast breeder reactors are among the subjects of research and development for the years ahead which we are tackling in cooperation with IAEA and under bilateral and multilateral agreements with other countries. Japanese cooperation in all these matters will go on augmenting.

(3) Asian trainees have been received for study in Japan through the medium of the Japan International Cooperation Agency. In addition, since we participated in IAEA's RCA project in 1978, we have done all we can, though in a small way, to help develop activities in the field of radiation use. In 1963, although it may not be within the memory of most people, Japan sponsored an Asian and Pacific atomic energy conference. Japan was then still backward in the matter of atomic energy, it was proposed in the hope that backward Asian countries would somehow cooperate among them to derive benefits from the peaceful uses of atomic energy. It was ceased only at one time when it was premature, but Japanese enthusiasm for cooperation with other Asian countries remains intact. But Asia today is not what it used to be, and it is in complicated circumstances. The speaker will give out his personal views on approaches for Japan to make and some opinions he may offer to other countries in the light of Japanese experience.

THE IAEA's ACTIVITIES IN TECHNICAL CO-OPERATION IN THE ASIAN REGION

C. Vélez Ocón
Deputy Director General for Technical Cooperation
International Atomic Energy Agency

The technical co-operation programme of the International Atomic Energy Agency encompasses all fields of nuclear science and technology. For many developing countries, the applications of isotopes and radiation in medicine, agriculture, hydrology and industry, are the most important uses of nuclear energy. In countries where geological conditions are favourable, exploration of uranium is of interest. For the most industrialized of the developing countries, nuclear power is already a reality, or is being actively considered. More than 25% of the Agency's technical co-operation expenditures are used for assistance in specialized fields related to reactor technology, the nuclear fuel cycle and nuclear safety. In promoting technical co-operation, the Agency imposes the restriction that "the assistance provided shall not be used in such a way as to further any military purpose".

Among the regions of the world, Asia and the Pacific receives about one quarter of the total assistance delivered but this region accounts for close to half the projects in nuclear engineering and technology. For ten years the Regional Co-operative Agreement for research, development and training (RCA) has brought together work of the IAEA and Member States in Asia and the Pacific. Current RCA projects concern health care, food and agriculture, hydrology, and industry. The industrial project, partially funded by the United Nations Development Programme and executed by the IAEA, aims to expand and accelerate the uses of isotopes and radiation technology in five fields of industrial application.

For countries considering to embark on nuclear power programmes, the IAEA can offer, through multi-year interregional projects, assistance in the fields of energy and nuclear power planning, site selection, and in the application of the new Basic Safety Standards. In response to specific requests from Member States, the Agency supplies expert services and equipment in a variety of subjects related to nuclear power and in particular in the field of nuclear safety. Also within the framework of its technical assistance programme, the Agency organizes training activities through fellow-ships, courses, scientific visits and study tours. Since 1975 the IAEA has conducted a series of training courses on nuclear power, from general planning to scpeific management and technical subjects. Outside the regular programme of technical assistance, missions can be undertaken to help Member States in the implementation of the Agency's Nuclear Safety Standards (NUSS) programme and, more recently, operational safety review teams have been sent, at the request of Member States, to review safety aspects of operating nuclear power plants.

The IAEA contributes to the transfer of nuclear technology in many ways. For more than 25 years it has played the important role of an intermediary between Member States in the transfer of experience, information, materials and equipment. The Agency's global membership makes it an essential piece for the development of nuclear technology in a peaceful world.

CANADIAN EXPERIENCE IN THE TRANSFER OF NUCLEAR TECHNOLOGY

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Atomic Energy of Canada Ltd.
Canada

The benefits of a nuclear power program extend far beyond the supply of reliable and inexpensive energy. A comprehensive nuclear power program will impact on many sectors of the economy, through engineering, manufacturing and construction of the power plants and through associated research and development. As a result, the transfer of nuclear-related technology is often a significant feature in the acquisition of nuclear power plants by non-nuclear countries.

CANDU, the natural uranium fuelled, heavy water moderated reactor system, presents several advantages of interest to a non-nuclear country. It is a system through which Canada, itself a country without a well-established, large-scale industrialized base at the start of its nuclear program, has been able to develop an autonomous nuclear industry.

The experience gained in establishing its own nuclear industry and a long involvement with technology transfer at home and abroad puts Canada in a unique position to understand and develop the scope and processes of technology transfer essential to the development of a successful nuclear program. Through Atomic Energy of Canada Limited, Canada can offer the collective experience of the whole nuclear industry in a program which can be tailored to suit the needs and capabilities of each individual country.

Experience in the transfer of nuclear-related technology to CANDU purchasing countries is used in the paper to illustrate the principles involved and the factors which are essential to the successful transfer of technology. The CANDU system, by virtue of the emphasis given to simplicity of design and component manufacture and the availability of Canadian technology, is within the manufacturing capability of most semi-industrial or developing countries. When coupled with its natural uranium fuel cycle, CANDU does indeed, offer a country the prospect of self-sufficiency in its nuclear program.

Table 1 Summary of Indian Nuclear Power Program

Station	Type	Capacity MWe	In-Operation	Local Content %
Tarapur-1	BWR	210	1969	30
Tarapur-2	BWR	210	1969	30
Rajasthan-1	PHWR	220	1972	55
Rajasthan-2	PHWR	220	1980	70
Madras-1	PHWR	235	1984	88
Madras-2	PHWR	235	1984-5	88
Narora-1	PHWR	235	1986-7	89
Narora-2	PHWR	235	1987-8	89
Kakrapar-1	PHWR	235	1990-1	90
Kakrapar-2	PHWR	235	1991-2	90

Table 2 Some Examples of Changing Source in the Rajasthan Project

Item	Unit 1	Unit 2
Prime contractor	Ind	Ind
Nuclear system design	Can	Can
Conventional system design	Can	Can/Ind
Calandria	Can	Ind
Moderator Dump Tank	Can	Ind
Absorber Rods	Can	Ind
Nuclear fuel	Can/Ind	Ind
Fuelling machines and carriages	Can	Ind
Steam generators	Can	Ind
Turbine generator	Can/UK	Can/UK
Condenser	Can/Ind	Ind
Feedwater heaters	Can	Ind
Instrumentation	Can/Ind	Ind
Civil, Electrical and Mechanical Installation	Ind	Ind
Commissioning	Can	Ind

Table 3 Summary of Indian Trainees in Canada

Location	No.	Man-years
AECL Design Group	34	42.9
Ontario Hydro Operations	46	85.1
Ontario Hydro Construction	9	7.7
Consultants & Manufacturers	18	11.9
Total	107	147.6

Table 4 Summary of Canadian Staff in India

Function	Source*	Location	No.	Man-years
Engineering (design, procurement, manufacturing inspection)	AECL	Bombay	12	27
	MECO	Bombay	20	44
	DB	Manufacturers	5	7.5
	CV	Manufacturers	1	1
Resident Engineers	AECL	Site	7	21
	MECO	Site	23	53.5
Construction/Erection Supervision	AECL	Site	1	3
	DB	Site	3	5
	EE	Site	8	13.5
	Sulzer	Site	1	1
Commissioning	OH	Site	20	53.5
		Total	101	230

* MECO = Montreal Engineering Co.
DB = Dominion Bridge
CV = Canadian Vickers
EE = English Electric
OH = Ontario Hydro

INTERNATIONAL COOPERATION IN NUCLEAR ENERGY

Mohamad Ridwan
Deputy Director General
National Atomic Energy Agency
Indonesia

A gneral phenomenon in the second part of 20th century is the strong effort of developing countries to foster their developments towards a narrower gap from the developed countries through the applications of modern technology and industrialization. The developing countries generally have a big population with a lower living standards, rich in natural resources but poor in science and technology. Efforts to elevate the living standards of the people in developing countries through industrialization programmes is a quite sophisticated problem due to limitation of capability in Science and Technology.

The process of technology trnansfer from the developed countries to the developing countries is not as smooth as expected, especially in the recent years improvements are attained through the more pronounce role of the international organizations such as IAEA, UNDP, and also the increasing developments of strong bilateral cooperations.

BATAN, which was found in 1958, has the main mandates to execute, regulate, and control of research and application of atomic energy in Indonesia for the benefit of safety, health, and welfare of the Indonesian people.

Based on these main mandates, BATAN has set up a program on nuclear energy in Indonesia starting from exploration and exploitation, processing, purification, metalurgy, and fabrication of nuclear materials, nuclear instrumentation, all the way to reactor safety. Program on nuclear science and technology is set up in line with the plan on the use of nuclear energy as one of the energy sources in Indonesia approaching the year of 2000.

Program on radioisotope production and application are also received a great attention in the form of "quick yielding" programmes.

Realizing shortage of capability in nuclear science and technology and limitted number of skilled man-power in nuclear fields, international cooperations (multilateral, regional, bilateral) are being developed and intensified to run the program on nuclear energy.

So far multilateral cooperations have been developed through IAEA and UNDP in the forms of technical assistances which also include expert services and fellowships in various fields according to priorities. Regional cooperations are also in progress through the same international agencies under the RCA and RC Programmes.

Bilateral cooperations in various nuclear activities are also developed with many countries in Europe, Asia and America.

As the infrastructures of R & D are being sufficiently developed with the avilability of sufficient number of skilled man-power, Indonesia is now starting with business contracts with a number of suppliers from different countries in the effort to meet the possibilities of the application of nuclear energy as sources for electricity in the country. In these business contracts, choice is also made based on the factor of technology transfer.

Based on facts we obtained so far, improvements are needed in the international cooperations in several fields such as nuclear safety, emergency assistance, nuclear waste disposal, in addition to the nuclear applications in other field of activities.

TECHNICAL COOPERATION IN NUCLEAR SCIENCE AND TECHNOLOGY

Noboru Amano
Vice President
Japan Atomic Energy Research Institute
Japan

Technical cooperation to developing countries by Japan has been conducted mainly in the application of radiation and radioisotopes. Cooperation in the fields of research reactor utilization and nuclear safety will be increasingly important since both fields are the base for introducing nuclear power plants in the future.

1. Radiation Application

In the Sub-Project Radiation Processing which is the largest component of RCA/UNDP Project, a radiation vulcanization plant of natural rubber using Co-60 of 220 kCi designed by the experts of the Japan Atomic Energy Research Institute (JAERI) was in commissioning in December 1983 and is smoothly operated. In addition, a wood surface coating plant using electron beam accelerator is under manufacturing to be installed in Indonesia. The Japanese resident expert and short-term experts are playing important role for successful operation of the rubber plant leading to technology transfer. A bilateral cooperation agreement between JAERI and BATAN (National Atomic Energy Agency) of Indonesia in the field of radiation application is under preparation.

2. Food Irradiation

Under the RCA framework, Japan has been supporting the food irradiation project in financing and expertise. Irradiation of onions, tropical fruits, spices and dried fishes has been studied with the cooperation of JAERI and the National Food Research Institute. The 2nd Phase of the Project is proposed by IAEA to implement experiments in pilot scale aiming the promotion of commercial use of irradiated foods.

3. Research Reactor Utilization

Most of developing countries in Asia are operating research reactors. These reactors, however, are not always efficiently used because of the lack of experts and instruments to be attached. Research reactor is useful for practical applications, such as isotope production and activation analysis, and for basic research, such as reactor physics and radiation damage of materials. Abother important role of research reactor is to provide the base for introduction of nuclear power plants.

It is desirable that Japan, through JAERI and universities, will cooperate to developing countries in reactor operation, maintenance and utilization.

4. Nuclear Safety

Nuclear power plants are in operation in a few developing countries in Asia including the Republic of Korea, India and Taiwan. There is a trend for other developing countries to introduce nuclear power plants. Assurance of safety is most important in the promotion of nuclear power. In this respect, it is required that Japan transfers the technology of light water reactor safety, treatment and disposal of radioactive wastes, environmental radiation monitoring and radiation protection.

For effective promotion of technical cooperation in nuclear science and technology, careful consideration should be given in the following points; (1) needs and infrastructure of developing countries, (2) bilateral cooperation in comparison with maltilateral one, (3) combined support of experts and equipments, and (4) importance of man power training.

NUCLEAR COOPERATION WITH DEVELOPING COUNTRIES

Akio Horiuchi
Councillor of the
Director-General's Secretariat
Science and Technology Agency
Japan

Japan, an economic power ranking second in the Free World, stands in interdependent relations to the developing countries as they are closely tied by trade, natural resources, energy and so forth. That is why we believe that one of the most important ways open to us to contribute to world peace and stability is to give more of our economic and technical cooperation to the developing countries. In fact, this finds typical expression in the efforts we are making to attain a mid-term goal set for official government assistance in five years ending in 1985. We are trying to appropriate more than twice over the $10 billion we spent for that purpose during the preceding five years (1976-80).

On the other hand, it has become clear since the oil crisis that energy poses problems more serious for the developing countries than for the industrialized nations. Developing countries aware of the importance of nuclear power as an energy source economical and dependable from a long and medium-range point of view are intent on the development of nuclear power, although its extent varies from country to country. The circumstances are such that these countries hold out high hopes for Japanese cooperation in the field of nuclear energy. Nuclear energy is emerging as an important area of cooperation we have to extend to the developing countries.

Contributing toward world peace and stability by extending more cooperation to the developing countries, as stated above, is, needless to say, the basic policy we have to follow in our further efforts, as an advanced nuclear energy nation, to lend our cooperation to the developing countries. Moreover, it should be noted that a reactor accident, should it happen in any of the countries making an extensive use of nuclear power for electricity generation, would have enormous consequences for its neighboring countries, including Japan, and that as the developing countries are claiming more of a voice in the international areas, we will have to give more consideration to our mutually trusting relations with them. The significance of strengthening our relations with the developing countries in the field of atomic energy seems great in that it will help smooth the way for the development and utilization of atomic energy in Japan.

Some of the important points we have to make in our further efforts to lend our cooperation to developing countries in the field of atomic energy are set out below:

First, cooperation should be promoted in areas restricted to peaceful purposes. Japan's Atomic Energy Basic Law restricts the development of atomic energy in this country to peaceful purposes, and it is necessary that this principle should be followed in promoting cooperation with other countries. In this connection, consideration should be given to the cause of nuclear non-proliferation in line with broadly accepted international standards.

Second, cooperation should be promoted from the longest possible point of view. Atomic energy is a sophisticated and big science whose sound development needs to be based on broad and solid technical and economic foundations. Nuclear power generation would be more of a risk than most if it were introduced hastily without laying such foundations for it. It is most desirable that developing countries, with due consideration for the energy conditions as they are in the countries and the standards of science and technology they have attained, should draw up long-term nuclear power development programs, so that Japan could lend its cooperation along the lines of those programs. To make sure that cooperation does not at least end in a claptrap, it is necessary that Japan and any country obtaining its cooperation should work out an appropriate cooperation plan from long-term point of view.

Third, cooperation should be promoted with emphasis on the flow of personal interchange. Technology and material transferred to developing countries should not simply be received by the countries without training people for the use of the technology and material. If Japan is to smooth the way for cooperation with developing countries, the interchange of personnel should be encouraged to promote a mutual understanding and built trusting relations between them. In addition to trainees being received and specialists sent out for the purpose of technology transfer, it will be necessary to have engineers in leading positions and government officials call on each other so that the interchange of personnel in the years ahead will be enriched both in quality and in quantity.

The above are some of the points that seem important in promoting Japanese cooperation with developing countries in the field of atomic energy. But the reality is such that we have no adequate system established for such cooperation. We are in no easy financial circumstances, but it is to be hoped that all related organizations, governmental and private alike, will join forces to establish an efficient system. The developing countries are requested, if Japanese cooperation is to be stepped up, not only to make requests, but also strive to make self-help efforts and establish a principle of self-responsibility.

BROADER PERSPECTIVE ON INTERNATIONAL COOPERATION IN NUCLEAR POWER GENERATION

Kun-Mo Chung
Chairman and President
Korea Power Engineering Company, Inc.
Korea

It is important to recognize that no nation has the luxury of operating within an isolated, self-sufficient, national economic system any longer. In an increasingly interdependent global economy, technologically advanced countries must deal with newly industrializing countries on a mutually beneficial basis. Nuclear technology, which opened ways of developing an important new source of power generation and medical and industrial applications, must be shared among developed and developing countries. In the field of nuclear power generation, both the supplier nations of nuclear power technology and the recipient nations should work together in order to maintain the viability of the world-wide nuclear power industry and improve reliability, safety and economics of existing and futrue nuclear power plants. Issues such as designing more 'forgiving' and economical nuclear power plants, improving operation and maintenance, establishing nuclear waste management policies and stabilizing nuclear regulatory systems could be resolved more readily and reasonably through international cooperation. For example, the idea of an international commission on nuclear safety could benefit substantially the newcomer nations in nuclear power generation.

An important and potentially powerful instrument for the international approach in nuclear technology is regional cooperation which may enable participating nations to save time and funds in developing and operating nuclear power generation facilities. Regional cooperation in reactor operator training, emergency response, spare parts pooling and standardized codes are examples of interesting schemes in which participating nations can save expensive investments allowing for the exchange of experience and know-how. It should be noted that the forthcoming fifth Pacific Basin Nuclear Conference to be held in May, 1985, will specifically address regional cooperation in the above mentioned topics.

Technology transfer from supplier nations to recipient nations is usually connected to the issue of technological self-reliance of recipient nations. It is to be noted, however, that the ever-increasing interdependency of the global economy demands a broader interpretation of technological self-reliance. The capability of conducting technological diplomacy on reciprocal bases is more important than the capability of achieving self-sufficiency. International cooperation in developing nuclear technology and its application, particularly in the power generation area.

A NEW STAGE OF INTERNATIONAL COOPERATION IN NUCLEAR ENERGY

L. Manning Muntzing
Doub and Mutzing, Chartered
U.S.A.

Nuclear power is expected to be an important source of energy production by 42 nations in the coming years. This is a significant change from today's level of activities and presents the question as to how best to achieve public nuclear safety everywhere in the coming years.

While each country can undertake to develop its own basic approach to public nuclear safety, an approach that can better protect the people of the world should be based on international cooperation since many technical issues transcend national boundaries.

There is a disparity between nations with regard to their experience with peaceful nuclear uses. However, most of the more technically advanced countries in the nuclear field have committed themselves in formal treaties to cooperation with other countries so that all nations party to the formal treaties can receive the benefits of peaceful nuclear uses.

A nuclear power problem anywhere is of concern everywhere. Thus, the emerging nuclear power nations desire the best possible technical concepts, and the more developed nuclear power nations are best served themselves when they share their expertise.

Duplication of effort is expensive and only desirable where some overriding interest is present. Therefore, where possible, international cooperation can bring together the best scientific and technical thinking from throughout the world so that duplication of effort is avoided, and all nuclear power nations are given the opportunity to contribute and to share in the major nuclear issues.

The International Nuclear Societies Group appointed a committee that recommended the establishment of an International Commission on Nuclear Safety. At this time, the International Atomic Energy Agency is studying this question further which may lead to greater cooperation internationally on nuclear matters important to public safety.

Thursday 15 March

2:00 pm - 5:00 pm
SESSION 5 BEARING OF NUCLEAR POWER ON PUBLIC ACCEPTANCE

There is a growing social recognition of the necessity for a stable supply of energy and for nuclear power generation. But there is not enough public understanding of the development of nuclear power to overcome all problems standing in the way of a consensus of opinion. Relations between national life and nuclear power will be discussed from various points of view, such as energy security and regional economic activity, aimed at helping to win public acceptance for the development of nuclear power.

ECONOMIC AND SOCIAL IMPACT OF NUCLEAR POWER PLANT ON LOCAL COMMUNITY

Hitoshi Sasao
Professor
Nihon University
Japan

1. It looks that the national policy for encouraging the siting of nuclear power plants need to be re-examined, considering the following changes in general situations.

(1) Already, considerable experiences on siting has been gained.

- ○ It is already 18 years since Tokai Nuclear Power Plant commenced operation in 1966.

- ○ Of 16 nuclear plant sites on which agreement have been reached, the construction of plants completed in 3 sites. Additional units are being constructed in 8 sites, and new constructions have started or in preparation in 5 sites.

- ○ 10 years have passed since the three legislations for promotion of electric power development have been enacted in 1974.

(2) The energy situation has changed drastically in recent years.

- ○ The tight balance of demand and supply of electricity has been alleviated.

- ○ More emphasis is placed on the reduction of the cost of nuclear power plant.

- ○ Sophistications in the technology of nuclear power plants.

(3) The philosphy of the regional development programs has become quality oriented, changing from the quantity oriented policies in the past.

- The concept of developing regional society by its own initiative has been accepted more generally.

- Urgent need in reducing the government expenditures.

2. The change in the local community is caused by huge investment programs such as the nuclear power plants, is determined by the type and the size of the facility introduced in the short term. In the long term, however, the effect is diverse depending on the geographical conditions and the initiatives of the community for development.

(1) The patterns of changes.

- The stage of agreement. Construction stage. Operation stage.

- Type of investment. Type of community. Type of changes.

- The effect produced by outside force. The effect created by internal initiative.

(2) Observations of changes at three sites of Fukushima No. 1, Mihama and Genkai.

- Areas where direct effect is pronounced: Creation of "construction community." Business related to the construction. Financial status of local government.

- Propagation of economic effects.
  The effect on the economy of the original community is indirect, and varies according to the field of economic activities and local characters.

The effect is dependent to the initiatives of residents and local government; with proper initiatives, economic effects can be amplified.

- General observations.

3. The degree of development of a site community, by introduction of large investment, is dependent on the initiative, insight and cooperation in the community. In the siting programs of nuclear power in future, the local and specific characteristics of the site communities must be carefully studied, and integrated and coordinated designs for the development of communities must be provided.

(1) Considerations especially needed for nuclear sitings.

- The long-termed planning for absorbing the huge impact of construction activities.

- Provisions to overcome the transient nature of the large fund supplied to the community.

- Creation of a structure which assures long term or continued development activities, such as introducing new industry or coordinating the siting activities with the general regional development policies.

(2) Proper frameworks for the basic planning.

(3) Creating initiatives for regional development.

SAFETY REGULATION AND PUBLIC ACCEPTANCE

T. Roberts
U.S. Nuclear Regulatory Commission
Commissionar
U.S.A.

The U.S. Nuclear Regulatory Commission (NRC) was created by congressional enactment in 1974, following over 20 years of regulation of the commercial nuclear industry by the former Atomic Energy Commission. The NRC became the regulator of the industry, while the promotional and developmental role of government in non-military nuclear applications was assumed by what is today the department of energy.

Under the Energy Reorganization Act of 1974, the NRC regulates the nuclear indstry for the protection of public health and safety and of the environment. The NRC is also concerned with protection of the national security, the export of nuclear materials and equipment, and compliance with Anti-trust-laws.

The safety philosophy of the NRC, called "Defense-in depth," comprises three distinct and mutually reinforcing levels of protection: first, by conservative design, providing more than minimally adequate margins of safety – Second, by backup equipment and systems, providing protection from effects of expectable failures of equipment and components – third, by special design features, providing protection from effects of unlikely but possible accident scenarios. In all cases, the objective is to prevent accidents to the extent reasonably achievable and to minimize and mitigate the effects of accidents that may in fact occur.

The NRC accomplished its purposes through the licensing of nuclear reactor plant construction and operation, the promulgation of standards, the issuance of rules and regulations governing licensed activities, and inspection and enforcement actions.

actions. The NRC also sponsors extensive research in support of all its regulatory interests.

The licensing of a nuclear power plant in the united states is a two-stage process. First, a construction permit must be granted to a utility wishing to build a nuclear power station – later, when the plant is near completion, the utility applies for an operating license. Public hearings are part of the construction permit phase, as a matter of law. The facility remains under NRC jurisdiction throughout its operating life of about 40 years, subject to regular inspection and to any new requirements deemed necessary by the NRC. Licensees in violation of NRC regulations are subject to financial penalties.

The NRC is currently testing the applicability of explicitly defined safety goals calling for a level of protection such that individuals and society at large will bear no additional risk to life and health because of nuclear power plant operations. The goals are formulated with specific numerical values expressing the acceptably low levels of risk intended to result from regulation.

In the international spere, the NRC participates in the exchange of safety information with 21 other nations, the licensing of nuclear exports and imports, and nonproliferation efforts of the International Atomic Energy Agency.

RADIOACTIVE WASTE AND PUBLIC ACCEPTANCE

Howard K. Shapar
Director General
OECD Nuclear Energy Agency

The disposal of radioactive waste is often perceived as one of the more intractable issues thwarting public acceptance of nuclear power. The fact that the management of long-lived wastes requires long-term solutions involving important ethical, organisational and technological issues, has led some to argue that contemporary decision-makers should refrain from making decisions today which may be largely irreversible, in the absence of "absolute" certainty over the safety of disposal.

On the other hand, there is a clear consensus of informed expert opinion that "the technology is available ..." and that, from a technical standpoint, ultimate disposal of high-level waste does not require urgent action, as there are several satisfactory methods available for safe interim storage.

At the national level, as might be expected, the disposal issue is being treated with varying degrees of urgency. Some OECD countries are now developing plans for the final geologic disposal of long-lived waste or spent fuel. Others have decided that the decision whether to proceed forthwith with development of final repositories can be postponed until a later date. Still others have made it a condition that a satisfactory overall solution of the waste problem be demonstrated before proceeding with any further development of their nuclear power programmes.

Against this background, the fact remains that public acceptance of nuclear power is being impeded in some countries by public perception that the waste issue remains outstanding.

The solution this problem presents a substantial challenge to the national and international communities, because it requires both a better public understanding of the issue and the build-up of the necessary degree of confidence that the long-term institutional, regulatory, technological and economic aspects of the problem have been properly addressed, and that ultimately neither man nor the ecosphere will suffer an unacceptable detriment from the solutions adopted for the management of wastes.

The paper presents a brief overview of those efforts and achievements, both national and international, which may usefully contribute to building up public confidence in the feasibility and safety of radioactive waste disposal.

NEW TECHNOLOGY AND PUBLIC ACCEPTANCE

Toshikazu Shibata
Professor
Kyoto University
Japan

1. Modern technology is a tool which can turn out both as swords and plows. It has the potential of serving human beings and at the same time destroying them. This potential seems to be especially large with the nuclear power. Those who are engaged in research and development of modern technology must not deny this grim fact. Those who would say, "we are doing this because this is good for them. They have no right to complain," are not faithful to their duty. This kind of attitude can not provide answers to the concerns of the public, which, often simple and native in logic but may contain some amount of truth.

2. We know that development of new technology always go through the process of trials and errors before it is completed. If one is so eager in stressing the safety of a new technology, that he pledges the public that he never makes mistake whatsoever, safety related or not, then his attitude may not be sincere, and not suitable for the job of introducing new technology. The public is not blind. The only way to convince them is to explain the plain scientific truth, to promise that one would try his best and finally prove that he has done his best.

3. How can we deel with the people who agrees that the development of nuclear power is necessary, should be encourages, anywhere but their own neibourhood? Again, sincere and persistent persuasion may be the only answer.

4. It seems that both proponents and opponents of nuclear power in Japan are displaying their reasonings and discussions based on scientific data that are produced in foreign countries. This is one of the causes of confusion. More indigenous scien-

tific studies are needed because, both groups would behave more reasonably if they could debate with data developed by themselves.

5. The speaker has been involved in a number of serious technology development issues in the past. He would like to analize the outstanding examples to find a few suggestions for the future.