

REGIONAL COOPERATION IN NUCLEAR ENERGY DEVELOPMENT:

PACIFIC BASIN NUCLEAR COOPERATION COMMITTEE

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INTRODUCTION

For the Pacific Basin with rapidly growing demands for electricity, nuclear energy development has become one of the most important economic and technological issues. In the United States and Canada, where nuclear electric power technology was originally developed, nuclear energy has become an indispensable energy source. Japan has been expanding nuclear generating capacity ambitiously, and, at present, has the largest nuclear industry outside any nuclear weapons state. Korea and Taiwan of China stand out as having aggressive nuclear power programs. In comparison to GNP, Korea and Taiwan of China have more money invested in nuclear power programs than any one else. They devoted 25% and 40%, respectively, of each year's additional GNP to nuclear power projects during the period 1978-83. As of December 1986, the East Asia region is operating 46 nuclear plants capable of generating about 34 GWe. In addition to these operating nuclear plants, 21 plants with 18 GWe generating capacity are currently under construction in East Asia. The total nuclear generating capacity of the Pacific Basin area is close to half of the world's nuclear power generating capacity.

During the 5th Pacific Basin Nuclear Conference which was held in May 1985 at Seoul, Korea, a special workshop session was organized to examine potential advantages of regional cooperation in handling outstanding issues of nuclear power development in the Pacific Basin area. Conferees at the 5th PBNC examined the potential for regional cooperation in the subject areas of education and training, nuclear safety, codes and standards, and international pooling of spare parts.

Two conclusions came out of the discussion: one was that an internationally pooled inventory cooperative would economize maintenance of operating nuclear power plants significantly and in all subject areas, regional cooperation could offer benefits to the participating institutions. The conference recommended that there should be established a Pacific Basin Nuclear Cooperation

Committee (PBNCC) and four working groups under PBNCC should study issues of nuclear power and evaluate options for cooperation. Suggested areas for working groups were education and training, nuclear safety, codes and standards, and public acceptance.

In November 1985, the Pacific Basin Nuclear Cooperation Committee was formally established with the participation of Canada represented by Canadian Nuclear Association and Canadian Nuclear Society, Japan represented by Japan Atomic Industrial Forum, Korea represented by Korea Atomic Industrial Forum, Taiwan of China represented by Taiwan Nuclear Society and the United States represented by the American Nuclear Society. At the inauguration meeting in San Francisco, four working groups held their first group discussion. The Canadian delegation proposed a fifth working group on radwaste management. The present organizational structure of PBNCC is shown on Figure 1.

The second meeting of PBNCC and its working groups was held in April, 1986 at Tokyo, Japan. Each working group received reports on the selected topics and had intensive discussion on how to promote regional cooperation. The third PBNCC meeting was convened at Washington, D.C. in November, 1986 in conjunction with the annual meeting of the American Nuclear Society. The fourth meeting of PBNCC was held in Tokyo on April 12 and 13, 1987. At this Pacific Basin Nuclear Conference, working groups of PBNCC have been conducting further discussion on the selected topics. At this session of the 6th Pacific Basin Nuclear Conference, we present reports summarizing studies during the two year period and recommended action plans. The technical contents of PBNCC working groups are as follows.

PBNCC REGIONAL COOPERATIVE FOR POOLED SPARE PARTS AND INVENTORY MANAGEMENT

To guarantee high availability of nuclear power plants, it is necessary that the plants have immediate access to high cost, long lead

time equipment should failures of this equipment occur. However, it is uneconomical for each plant to invest in a total replacement capability since the failure rates for this type of equipment are low and replacement may not be necessary, or failures may occur relatively late in plant life and carrying costs for the equipment may cancel any economic gain. Also, investment in a limited number of spare parts is not satisfactory because failure may occur in equipment that is not supported by spares. Since most nuclear plants are purchased from a limited number of suppliers, they have a considerable amount of identical equipment. It therefore makes sense to set up a cooperative in which plant owners can jointly purchase high-cost spare equipment which might be expensive and have long manufacturing lead times. Typical equipment includes circulation lamps, motors, motor generator sets, injection pumps, large valves, transformers, generation components and diesel generators. These spares are interchangeable with equipment used in the original plants. Considering that a single nuclear plant has more than 25,000 distinct line items, the inventory of spare parts is complicated and very costly. Also a materials management system for a nuclear plant requires systematic purchasing, operation, quality assurance, and engineering. Rules for financing and allocation of this equipment would guarantee each participating plant access to high cost spares at a fraction of the full cost if each plant were to inventory the same equipment separately. The net savings of a pooled spare parts inventory program to PBNCC members would be more evident in maintaining high availability of plants. For smaller PBNCC members, a forced outage of a nuclear plant may leave too much of a gap to be filled by the rest of the system. A pooled spare parts inventory will minimize the length of plant shutdown time due to failure of long lead-time equipment.

The concept of a PBNCC pooled inventory management was enthusiastically endorsed at the 5th Pacific Basin Nuclear conference. A cooperative is now being studied by Inventory Management International, which is conducting studies on surplus equipment database, list of spares necessary for PBNCC members, and legal and financial matters. An important feature for a recipient is that the cooperative be able to provide joint qualification service of parts from disappeared suppliers.

#### PBNCC REGIONAL COOPERATION IN NUCLEAR TRAINING

With increased awareness of the important roles played by engineers, technicians and operators in connection with the safety of nuclear power plants, nuclear plant owners are keenly interested in setting up good educational and training programs for their staff members. For emerging nuclear power industries with relatively short experience, setting up such educational and training programs is not an easy task. The

PBNCC working group on education and training is reviewing a number of schemes through which Pacific Basin nuclear programs can benefit in staff development. One idea tested at the 5th PBNC was a Regional Operator Training Center. It was agreed that a single-site regional operator training center is not feasible but existing training centers can be opened up to receive overseas trainees. Special courses offered by special lectures can be shared by personnel from nearby utilities.

Following the model arrangements between Sweden and Yugoslavia, it was deemed feasible and useful to share training simulators among PBNCC utilities. Simulators will become more powerful tools for operator training and by combining resources a wider variety of simulator training can be formulated. Connected to this issue is the exchange of training materials among PBNCC training centers. At the workshop it was suggested that PBNCC publish a listing of all training activities in the region.

Regional topical meetings and conferences are useful means of sharing valuable experiences among regional experts. The PBNCC working group is examining topics which would be practical to the operators of nuclear plants. In this connection the IAEA is seen as a sponsoring organization, which can respond effectively to the call by competent organizations engaged in nuclear activities. At the second workshop in Tokyo, the Institute of Nuclear Plants Operation (INPO) expressed its willingness to support PBNCC initiatives. The working group is pursuing mechanisms through which INPO can deliver assistance to PBNCC organizations.

In addition to the issues of training nuclear power plants personnel, the working group is also looking into those issues related to formal and continuing educational activities.

#### PBNCC REGIONAL COOPERATION ON NUCLEAR SAFETY

It was originally suggested that there may be special areas of nuclear safety which might be amenable for cooperation on a regional basis because of geographic or cultural considerations. There already exist arrangements for international cooperation in nuclear safety. They include the exchange of technical reports, specialists' meetings and workshops, collaboration in safety research, and joint review of plant safety.

At the 5th PBNC three areas for regional cooperation in nuclear safety were identified and discussed in detail. The first area was "cooperation practices and experience". As the number of operating plants increases in the region, utilities could voluntarily agree to develop criteria for operating data and incident or event reporting, and submit such data to a cooperative bank for references and analyses. The first step in this area could be annual specialists' meeting among operators and reactor supervisors in the

Far East. In this exchange, information on maintenance practices could be extremely useful. The PBNCC working group urged the participating utilities to hold such exchange meetings.

The second area was safety research. Regional cooperation is considered desirable and cost-effective in carrying out safety research, which covers many fields such as reactor physics, thermal hydraulics, structural analysis, corrosion science, radiation protection and, particularly, probabilistic safety assessment (PSA). It was suggested that a Working Group on Safety Research composed of technical experts from PBNCC be formed for the purpose of reviewing the status of safety research for regional cooperation.

The third area was "Emergency Planning". If a severe accident were to occur at a nuclear power plant, established emergency response plans and procedures for implementation are vital to cope with such accidents in the most effective and timely manner. Because of differences in social, cultural, and legal environments, as well as differences in plant design and construction, each organization should develop its own emergency plans. However, severe accidents would also cause transboundary impacts. Regional cooperation in protecting the public from radiation exposure, radiation monitoring, and accident detection and assessment would be mandatory. At the 5th PBNC, the working group strongly suggested that each member should set up emergency plans and even exchange them with their neighbors. At the 2nd PBNCC meeting, the working group decided to choose this topic as the workshop theme at this Beijing meeting.

#### PBNCC REGIONAL COOPERATION IN CODES AND STANDARDS

Consistency of technologies at some level is beneficial if organizations with different backgrounds and practices are to cooperate in nuclear technology. For this objective establishing a basis for mutual cooperation in codes and standards is a key task. The PBNCC working group on codes and standards is working to encourage the use of reasonably consistent criteria for the design, fabrication, construction, testing, operation, and maintenance of hardware components; systems, subsystems, and structures for commercial nuclear power plants among PBNCC members so as to

- promote comparable safety standards
- encourage commerce among PBNCC members
- reduce costs of fabrication, construction, testing, operation and maintenance, and
- facilitate the sharing of spare parts inventions.

The problem of starting a process leading to mutual cooperation centers on the plethora of existing current standards, such as ANS, IEEE, ASME, ISO, IAEA, IEC, CAN, USNRC, Reg. Guides,

etc. Fortunately, the Nuclear Safety Standards (NUSS) generated by IAEA provide a good international reference in organization, siting, designs, operations, and quality assurance. NUSS is almost complete and lends a particularly effective base for international cooperative efforts in design, operation, and quality assurance. In addition, standards by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) provide bases for common practices in goods, services, instrumentations, and controls. Since IAEA, ISO, and IEC standards are integrable and internationally accepted, the PBNCC efforts to promote consistent criteria among members is promising. With this promise, the working group is now focusing its attention to identify similarities and differences and to find ways and means for regional cooperation to further consistency in codes and standards. It should be noted that a PBNCC codes and standards system is impractical and not acceptable. Rather, this effort is to allow members to have understanding and flexibility in codes and standards so that mutual interdependence in developing and operating PBNCC nuclear programs exists.

As will be discussed in this session, the working group developed a "Codes and Standards Matrix" which was found to be very useful in classifying the various codes and standards. Using this matrix approach, a rather comprehensive cross-indexing and comparative analysis of technical contents of American ASME and French RCC-M have been developed using the data from KNU 7/8 (Westinghouse PWRs) and KNU 9/10 (Framatom PWRs). This comparative data base will be of great interest to those with nuclear reactors from more than one country of origin and may provide an important technical reference for regional cooperation.

#### PBNCC REGIONAL COOPERATION IN PUBLIC ACCEPTANCE

In the current debates on nuclear energy, the public is easily exposed to misleading and incorrect statements about the nature, risks, and benefits of nuclear power generation. The subject of public understanding or acceptance is quite relevant to every facet of nuclear energy. The PBNCC working group on public acceptance recognized the inseparable relationship between public acceptance and national policy and the potentially effective roles played by non-government international organizations like PBNCC.

During its first and second meetings, the working group found inconsistencies in materials presented and used during promotional activities and regulatory activities of nuclear energy. The group felt that such inconsistencies would increase public worries over nuclear energy and the public would discredit both. Thus, the aim of the working group is to make contributions in the consensus building process on nuclear energy.

Various activities are currently under discussion. One item of action is to exchange instant clarification of events which might cause an impact on public acceptance. Exchange of information on sensitive issues connected to nuclear energy is also encouraged. The group stressed the importance of papers written by multiple authors from nuclear programs. PBNCC can promote such multi-authored papers on energy-environmental-economic issues. A structural approach to international media relations is also considered effective. There exist gaps between the media and the professional community. One way to reduce such gaps is to promote a visit program by journalists, industrialists, bureaucrats, politicians, and other opinion leaders to nuclear power installations. Such a program will help to raise the profile of nuclear facilities and public understanding. In reverse, there are clear and present opportunities for expert speakers to participate in non-nuclear conventions, meetings and symposia, and present the positive cases for civilian nuclear programs. The PBNCC working group is currently looking into establishing a working system to handle public acceptance activities in the Pacific Basin area.

It should be noted that the Chernobyl accident was the central theme discussed by the working group at the 3rd PBNCC meeting at Washington. Government actions, parliamentary responses, industry's reactions and public opinions in the Pacific Basin region were discussed in depth. Again, it was agreed that joint activities would be very beneficial in improving public understanding of nuclear energy and thus enhancing public support for continued utilization of nuclear energy.

#### PBNCC REGIONAL COOPERATION ON RADWASTE MANAGEMENT

The radwaste issue is one of the most discussed issues in connection with further expansion of nuclear power generation. To encourage collaboration among PBNCC members in this area, it was proposed to form a PBNCC working group in radwaste management. The working group would study an effective program for the exchange of technical information among members arising from R&D programs and operating waste management experience so as to promote consistency in approaches, practices, and in regulatory criteria. A second proposal was to form joint R&D programs among PBNCC members on radwaste management to minimize the R&D cost. Also proposed is to establish a joint program review panel comprising independent, distinguished scientific experts from each member which, on request from a member, will review a particular waste management program and advise as to the soundness of the program. Such independent, high-level, international reviews should substantially assist in public acceptance programs.

During the discussions at the 2nd PBNCC

meeting in Tokyo representatives suggested PBNCC studies on underground disposal, ocean dumping, acceptance criteria for radwaste packages, low-level wastes, and high-level wastes.

#### CONCLUDING REMARKS

Currently six Pacific Basin members have been participating in PBNCC: Canada, Japan, Korea, Mexico, Taiwan of China, and the United States. The People's Republic of China has sent observers to the PBNCC meetings. Representatives from Indonesia have indicated an interest in participating. Participation by other countries on the Pacific Basin are open and under discussion. Also, the scope of coverage by PBNCC is expected to be broadened. Because participants in PBNCC are from utilities, research organizations, manufacturers, engineering firms, service organizations, and public interest groups, PBNCC promotes broad cooperation among workers and specialists. PBNCC promotes regional cooperation in studies, research work, planning and implementation of regional cooperatives. Pooling limited resources and common market information are important advantages. Since nuclear energy technology is expected to undergo a major transition, PBNCC will benefit participants in evaluating new technological options in fuel cycle and reactor development as well as in safe operation of operating nuclear power plants.

During today's session, we will also hear about other regional cooperation, training and technology transfer activity in the Pacific Basin area.

In assessing nuclear energy, we have to keep in mind that not only the technological feasibility should be examined but the economic consideration also. Non-nuclear, non-conventional energy sources are economical for isolated, low intensity demands. However, unless there are some very unexpected surprises, nuclear fission energy is the only well-developed, non-conventional, non-fossil power option. Thus, regional cooperation is drawing much interest among Pacific nations and areas engaged in nuclear power programs.

(Figure 1)

PACIFIC BASIN NUCLEAR COOPERATION COMMITTEE

Coordinating Committee

(co-chaired by KunMo Chung & L. Manning Muntzing)

- Members of the Coordinating Committee

Gordon Brooks, James Weller, Victor Cheng,  
K.C. Liu, H. Murata, S. Hamaguchi, C.H. Rieh,  
J. Eibenschutz, M. Medina, Zack Pate

- Working Group on Nuclear Training

(co-chaired by C. H. Rieh & Ryohei Kiyose)

- Working Group on Nuclear Safety

(co-chaired by K. C. Liu & Walter Kato)

- Working Group on Codes and Standards

(chaired by Norman Edwards)

- Working Group on Public Acceptance

(co-chaired by Y. Tanaka & Ron Veilleux)

- Working Group on Radwaste Management

(chaired by Gordon Brooks & K. Uematsu)