2004

White Paper on Nuclear Energy
(Summary)

Atomic Energy Commission of Japan

Since the publication of its last White Paper on Nuclear Energy for 2003 (released in December 2003), the Atomic Energy Commission of Japan (AEC) has continued to monitor trends covering all aspects of nuclear energy over the period up to the end of December 2004, and summarized its findings in the “White Paper on Nuclear Energy 2004” concentrating especially on recent trends, which was released on March 4, 2005 by cabinet decision.

This paper is comprised of a main document and supplementary materials.

The first chapter of the main document summarizes the efforts to foster better understanding and trust both home and abroad, divided along the following topics: “Regaining public trust,” “Trust building for a new project,” “Securing the understanding and trust of international society,” “Efforts of Atomic Energy Commission of Japan to establish a new long-term nuclear energy plan,” and “Securing understanding and trust in the future.”

The second chapter concretely explains the recent activities of the government and the private sector based on the outline of “the Long-Term Program for Research, Development and Utilization of Nuclear Energy (Long-Term Nuclear Program)” established in November 2000, and covering the following topics: “Nuclear energy policy in Japan,” “Harmony between people, society and nuclear energy,” “Nuclear power generation and nuclear fuel cycle,” “Diversified development of nuclear science and technology,” “Utilization of radiation contributing to people’s lives,” “Harmony between international society and nuclear energy,” and “Foundation to promote research, development and utilization of nuclear energy.”

The supplementary materials include lists of AEC decisions, nuclear energy budgets, year-by-year data tables, etc.

In the following section, an outline of the main document is described.

A summary version of the first chapter of this white Paper may be found on AEC’s website at http://aec.jst.go.jp.

Part I: Main Document

Chapter 1: Fostering Better Understanding and Trust from Japan and Abroad

In promoting activities concerning nuclear energy, it is required not only to steadily implement risk management but also to fully explain risks and management methods to the public, to listen to their various opinions, and to go forward by fostering their better understanding and trust through communications.

In the international community, active discussions have continued on peaceful utilization of nuclear energy from the viewpoint of nuclear non-proliferation. Therefore, it has become increasingly important for Japan to win better understanding of our peaceful utilization of nuclear energy from the international community.

Chapter 1 summarizes the efforts by the government and the private sector to regain public trust after accidents, the activities to foster better understanding and trust in initiating new projects and the activities by the government to secure better understanding and trust on its policy from home and abroad mainly among the trends related to nuclear energy for the past year. At the end of the chapter, challenges for the future are pointed out.

1. Regaining public trust

At facilities utilizing nuclear energy in Japan, there have been serious accidents and incidents that have had significant influence on public and social awareness of the usefulness and the accompanied risks of nuclear activities.

When such an incident occurs, in order to resume the activity, the business entity and the government need pursue the following measures: to analyze the facts accurately; provide the results to the public to avoid arousing misunderstandings, anxieties, or false assumptions among communities; examine and study the cause; listen to public opinions; develop sufficient preventive measures; and give a full explanation to the public to faithfully implement them.

(1) Fracture of secondary system piping at Mihama Nuclear Power Plant Unit 3 (Kansai Electric Power Co., Inc.)

In August 2004, a fracture of the secondary system piping occurred at Mihama Nuclear Power Plant Unit 3. Kansai Electric Power Co., Inc. implemented work safety measures and leak detection at listed measurement points of wall thickness throughout the entire plant and announced the results to the public immediately after the accident.

The Nuclear and Industrial Safety Agency examined causes of the accident and compiled an interim report of the results in September 2004, delivering it to the mayors and the assemblies of the prefecture and the city where the plant is located. The Atomic Energy Commission of Japan made a decision on its view and its immediate action in October 2004.

Kansai Electric Power Co., Inc. compiled an interim plan for immediate measures such as securing work safety and for future tasks in September 2004. In this plan, they had decided to promote dialogue with local residents, which they implemented immediately. Furthermore, they have been conducting a further investigation of inappropriate management of wall thickness at the secondary system piping, aiming at securing reliable maintenance. They also announced that they have been considering transfer of the nuclear energy business headquarters to Fukui prefecture and that they would incarnate Fukui's scheme to be an R&D

base of energy.

(2) Leakage of pool water at Rokkasho Reprocessing Plant

In February 2002, leakage of pool water was confirmed at a spent fuel storage pool at Rokkasho Reprocessing Plant. Japan Nuclear Fuel Limited (JNFL) conducted checkups and repair of the fuel storage pool and all other facilities with the same structure.

The Nuclear and Industrial Safety Agency concluded that this inappropriate welding had resulted from the problematic quality assurance system of JNFL and required them to examine and improve the system. In response to this, JNFL conducted inspections, compiled the results and submitted them to the Nuclear and Industrial Safety Agency. Evaluating the report of the inspection results, the agency confirmed the soundness of the facility and decided to continue monitoring the progress of the improvement.

JNFL self-assessed its quality assurance system with regards to the said series of accidents and announced an improvement plan, including thorough quality assurance by the top management. JNFL reported the conclusion of quality assurance system inspection on the occasion of “Fureai (rapport) Visit,” the system in which JNFL employees directly visit the residents of Rokkasho. In April 2004, JNFL held a meeting to educate local residents. Furthermore, JNFL, in the same month, established “a local meeting” that consists mainly of eminent local residents, and reflected their opinions at “the Quality Assurance Management Meeting” with cooperative corporations.

JNFL has continuously implemented the above measures, reviewed its quality assurance system, conducted full inspections of reprocessing facilities, and received the government’s safety confirmation. In this way, JNFL has strived to win mutual understanding with local communities through various PR activities. Based on JNFL reports, the government’s evaluation, and opinions of the prefectural assembly, mayors, and the Aomori Atomic Policy Forum, Aomori prefecture accepted resumption of receiving of spent nuclear fuel in April 2004.

(3) Misconduct concerning inspections and examinations by Tokyo Electric Power Company (TEPCO)

With regard to misconduct concerning inspections and examinations by TEPCO, the Nuclear and Industrial Safety Agency evaluated the cracks found in the inspections by TEPCO and concluded that they do not immediately affect the safety of the nuclear reactors. As for misconduct concerning inspections of containment vessel leak rate, the agency imposed a one-year shutdown of nuclear reactors for a violation of the Nuclear Reactor Regulation Law, conducted inspections of containment vessel leak rate again and confirmed the soundness. The agency also imposed a shutdown of all the other nuclear reactors successively by April 2003 to conduct inspections of containment vessel leak rate.

AEC took these accidents seriously and made recommendations on regaining trust on the safety of nuclear energy to the Minister of Economy, Trade and Industry through the Prime Minister in October 2002. Meanwhile, based on the recommendations, the Nuclear and Industrial Safety Agency submitted a bill to the Diet to revise the Nuclear Reactor Regulation Law, which includes mandatory self-inspections and establishment of better quality assurance system. The bill was approved and the law came into effect.

TEPCO decided to aim at creating “corporate climate not to commit misconduct” and “a system unable to commit misconduct” based on in-house review of the accidents. They announced their future activities for ensuring thorough compliance with corporate ethics, improving environments for appropriate business operations, reforming organizational climate in the nuclear energy sector, and increasing in-house communications.

The communities where nuclear facilities are located established the “Information Meeting of Towns hosting Nuclear Power Plants in Fukushima” in order to check whether power plants are appropriately operated by emphasizing safety. Their questions were about the measures being taken by power plants.

TEPCO further strengthened the disclosure of information, explaining inspections and maintenance of power plants and preventive measures on various occasions in various ways. TEPCO has continuously made efforts mentioned above, conducted checkups and maintenance of facilities, received the government’s safety confirmation for each plant, explained the situation of plants and preventive measures to the local assemblies with the government, and reflected their opinions to preventive measures in a proper way. Kashiwazaki Kariwa Nuclear Power Plant Unit 6 restarted operation in May 2003, and the other units, which have received permission from the local communities, have followed one by one.

Figure 1-1　Information about Nonconformity Control on TEPCO’s Website

(4) Sodium Leakage at the Fast-Breeder Prototype Reactor Monju

The Monju plant has been shut since the leakage of secondary sodium coolant that occurred in December 1995. The government and the Power Reactor and Nuclear Fuel Development Corporation (PNC) (at present: Japan Nuclear Cycle Development Institute (JNC)) conducted a thorough investigation of the cause of the accident and studied preventive measures. The local residents filed an administrative lawsuit and a civil lawsuit with the Fukui District Court in 1985, demanding the nullification of the government's go-ahead for construction of the nuclear reactor. The government won the administrative lawsuit in the first instance but lost in the second; it is now appealing to a higher court[1]. The plaintiff dropped the civil lawsuit in March 2003.

After the accident, PNC (at the time) conducted a thorough investigation of the cause and a full safety inspection. Based on the results, they will enhance the safety of nuclear reactor facilities and will reconstruct facilities for preventing sodium leakage, including replacement and removal of thermometers.

Meanwhile, the Science and Technology Agency (at the time) complied reform plans through the review and adjustment of the PNC's operations, and the PNC was reorganized as the Japan Nuclear Cycle Development Institute (JNC) in October 1998.

Fukui prefecture formed a committee to confirm safety of the Monju plant from their independent standpoint, and this committee drafted and submitted the final report to the prefectural governor, stating "reconstructed "Monju" is a technologically safe facility."

The Ministry of Education, Culture, Sports, Science, and Technology established the "Monju" project team to gain public understanding in January 2003, and it has held briefing sessions and symposiums in Fukui prefecture. AEC has also cooperated on these activities.

JNC has had dialogue with a total of 1.18 million people by developing explanatory activities in 35 municipalities in Fukui and by visiting all the local residents in Tsuruga.

JNC has organized public seminars to disclose patents and to introduce technological performances, aiming at strengthening collaboration with local corporations in order to contribute to the revitalization of local business circles. Furthermore, JNC has supported joint courses with Fukui University by dispatching affiliate professors and assistant professors to give lectures.

(5) Improper irradiation in the medical field

Radiotherapy is one of the major treatments for cancer. However, cases of improper irradiation have become clear with a recent significant increase in radiotherapy patients, and this has cast doubts on its safety. In April, May, and December of 2004, the Ministry of Health, Labour and Welfare (MHLW) gave notice to each municipality to give proper guidance to medical institutions with regard to compliance with laws related to medical irradiation and thorough control system of radiation for medical purposes.

According to surveys by radiotherapy-related academic societies, improper irradiation seems to

[1] The government won the lawsuit in the high court's decision on May 31, 2005.

be caused by the lack of doctors specialized in radiotherapy and radiological technologists and the deficiency of quality control systems.

The related academic societies have worked hard to make guidelines and manuals for prevention of accidents, and have requested hospital managers and MHLW to correct an understaffing problem in the medical field. Furthermore, they organized a meeting for quality control of radiotherapy, and compiled a report showing the measures to carry out thorough quality control (QC) and quality assurance (QA) to prevent medical accidents in October 2004.

It was decided that the Japan Radiological Society and other academic societies would jointly accredit persons who have the capability to pursue quality control work mentioned in this recommendation and would establish a radiotherapy quality control organization to maintain and enhance their capability. Accreditation was to be commenced in spring of 2005.

Radiotherapy in Japan has entered a phase of major change. The movement of the above-mentioned academic societies and public-interest corporations corresponds with the change, and appropriate support by the administrative authorities is required to accelerate and direct the movement on the right course.

2. Trust building for a new project

In recent years, a new effort has been observed such as the start of trial operations at Rokkasho Reprocessing Plant. In order to implement such operation smoothly, the activities should follow the Long-Term Nuclear Program and the public needs to understand that the personnel are fully qualified for the operation. The trust can only be built through mutual understanding with the society with regard to the required capability for risk management of the personnel in charge. Therefore, risk communication should be maintained between both parties.

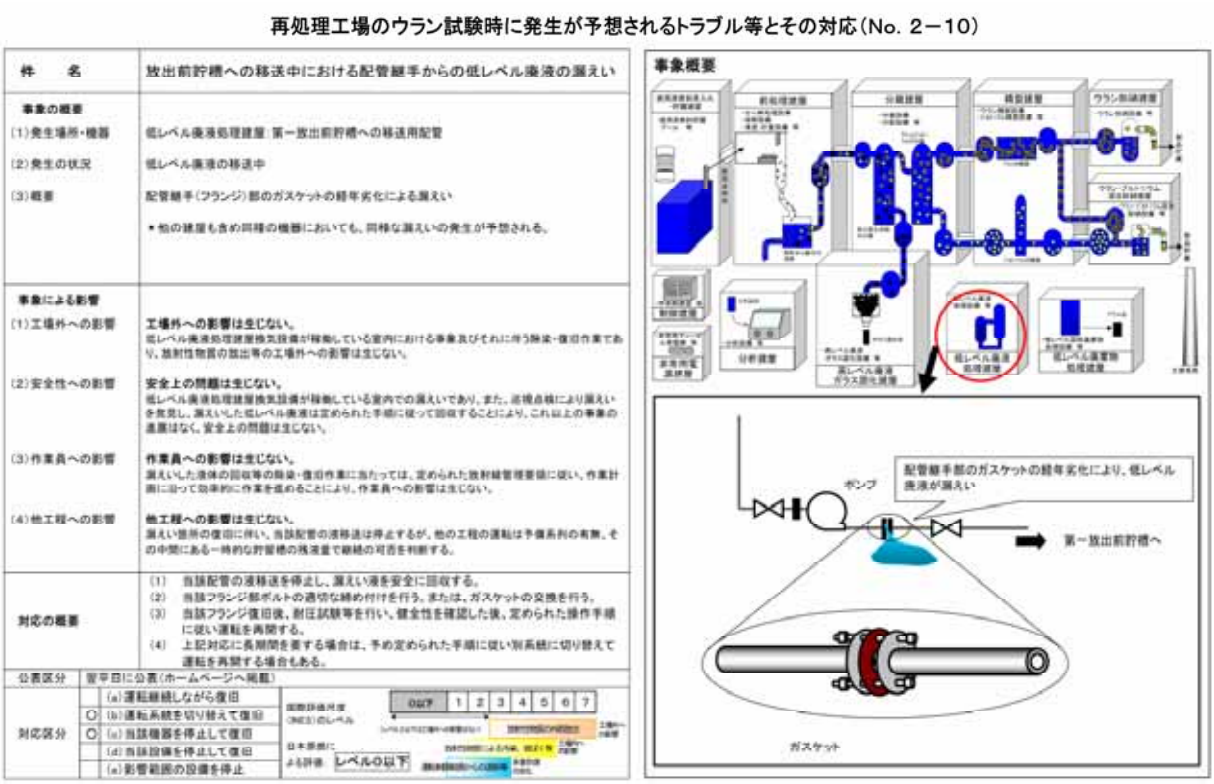
(1) For start of operation of Rokkasho Reprocessing Plant

Rokkasho Reprocessing Plant is now in the final stage of construction. According to the present schedule, “uranium tests” would be started in December 2004, and operation is to begin in July 2006.

In response to the leakage of pool water, JNFL conducted repairs of defective parts and a review of quality assurance system.

In advance of uranium tests at Rokkasho Reprocessing Plant, JNFL, analyzing internal and external experiences, made booklets compiling cases of expected major problems and restoration ideas to get ready for such emergencies, and tried to win mutual understanding from the local residents by publishing the contents in its PR magazines and on its website and by exchanging views at briefing sessions.

Figure 1-2　Examples of problems and responses (Excerpts from a problem booklet)



再処理工場のウラン試験時に発生が予想されるトラブル等とその対応（No. 2－10）

件　名	放出前貯槽への移送中における配管継手からの低レベル廃液の漏えい
事象の概要	
(1)発生場所・機器	低レベル廃液処理建屋 第一放出前貯槽への移送用配管
(2)発生の状況	低レベル廃液の移送中
(3)概要	配管継手（フランジ）部のガスケットの経年劣化による漏えい ・他の建屋も含め同様の機器においても、同様な漏えいの発生が予想される。
事象による影響	
(1)工場外への影響	工場外への影響は生じない。 低レベル廃液処理建屋換気設備が稼働している室内における事象及びそれに伴う除染・復旧作業であり、放射性物質の放出等の工場外への影響は生じない。
(2)安全性への影響	安全上の問題は生じない。 低レベル廃液処理建屋換気設備が稼働している室内での漏えいであり、また、巡視点検により漏えいを発見し、漏えいした低レベル廃液は定められた手順に従って回収することにより、これ以上の事象の進展はなく、安全上の問題は生じない。
(3)作業員への影響	作業員への影響は生じない。 漏えいした液体の回収等の除染・復旧作業に当たっては、定められた放射線管理要領に従い、作業計画に沿って効率的に作業を進めることにより、作業員への影響は生じない。
(4)他工程への影響	他工程への影響は生じない。 漏えい箇所の復旧に伴い、当該配管の送移送は停止するが、他の工程の運転は予備系列の有無、その中間にある一時的な貯留槽の残液量で継続の可否を判断する。
対応の概要	(1)　当該配管の送移送を停止し、漏えい液を安全に回収する。 (2)　当該フランジ部ボルトの適切な締め付けを行う、または、ガスケットの交換を行う。 (3)　当該フランジ復旧後、耐圧試験等を行い、健全性を確認した後、定められた操作手順に従い運転を再開する。 (4)　上記対応に長期間を要する場合は、予め定められた手順に従い別系統に切り替えて運転を再開する場合もある。
公表区分	翌平日に公表（ホームページへ掲載）
対応区分	(a)運転継続しながら復旧 ○ (b)運転系統を切り替えて復旧 ○ (c)当該機器を停止して復旧 (d)当該設備を停止して復旧 (e)影響範囲の設備を停止

(2) For promotion of Pluthermal

Pluthermal is the technology to recycle nuclear fuel utilizing existing light water reactors. Japan has implemented its research and development for realization since the early stage of starting utilization of nuclear energy.

AEC decided the concrete policy for nuclear fuel cycle, including pluthermal, in January 1997, and in February the cabinet meeting admitted, based on this decision, that pluthermal should be commenced immediately. In addition, the current Long-Term Nuclear Program and the “Energy Basic Plan” adopted at a cabinet meeting in October 2003 include the policy to steadily promote pluthermal.

Based on the “Energy Basic Plan,” the Ministry of Economy, Trade and Industry (METI) has implemented PR activities such as holding briefing sessions and lectures for local governments, assemblies, and residents of the communities in order to win public understanding of pluthermal.

Electrical power suppliers also make efforts to enhance interactive communications and support activities for energy education for children with the aim of promoting public understanding of pluthermal.

Meanwhile in 2004, the movement for realization of pluthermal started, as permission to change nuclear reactor establishment was applied for by Takahama Nuclear Power Plant (Kansai Electric Power Co., Ltd.), Genkai Nuclear Power Plant (Kyushu Electric Power Co., Inc.), and Ikata Nuclear Power Plant (Shikoku Electric Power Co., Inc.)

(3) For location of spent fuel intermediate storage facilities

AEC decided “on concrete current policy for nuclear fuel cycle” in January 1997, and in February based on this decision, the cabinet meeting recognized “current promotion of nuclear fuel cycle,” stating that “storage at facilities other than power plants would be considered.”

Based on this cabinet approval, discussions were held at the Science and Technology Agency (at the time) and the Department of Trade and Industry (at the time), and the “Law revising a part of the law concerning regulations of nuclear source materials, nuclear fuel materials and nuclear reactors,” which newly included rules concerning spent fuel storage business, was enacted in June 2000.

In the current Long-Term Nuclear Program, “intermediate storage of spent fuel is important as a measure to add flexibility to overall operation of nuclear fuel cycle, as it enables time adjustment during the period until the spend fuel is reprocessed.”

In response to this movement, AEC established the guideline for safety review of these facilities and the Nuclear and Industrial Safety Agency published a report on technical inspection.

In November 2000, TEPCO started a technology survey on location for spent fuel intermediate storage facilities with the request from Mutsu City, Aomori Prefecture. As a result, TEPCO proposed a report stating that the facilities can be constructed, and made public the concept of the business. Mutsu City conducted a review of the concept and requested TEPCO to construct the facility. In February 2004, TEPCO made a request for cooperation to Aomori Prefecture and Mutsu City and publicized the outline of the business.

Meanwhile, TEPCO held briefing sessions to explain the necessity and the safety of intermediate storage facilities to the local residents and various organizations, along with doing PR activities through door-to-door visits, study tours of cask storage facilities, and company’s website.

(4) For disposal of high-level radioactive waste

In May 1998, the AEC presented it as a basic principle that high-level radioactive waste should be disposed in the geological layer more than 300 meters underground (geological disposal) after its vitrified objects were stored for cooling for 30 to 50 years.

Based on the reports complied by the Nuclear Energy Division, The Advisory Committee for Energy (at the time), the government enacted the “Specified Radioactive Waste Final Disposal Act (Final Disposal Act)” in May 2000 in order to establish a framework for final disposal of high-level radioactive waste. This Act also established the Nuclear Waste Management Organization of Japan (NUMO) as a responsible organization by private initiative.

Following the Final Disposal Act, the related organizations such as the government, NUMO, and electrical power companies have struggled to improve public understanding by actively disclosing information through their website and emphasizing the importance of disposal in symposiums and forums they host throughout the nation.

In December 2002, NUMO started to publicly seek candidate sites from across the nation for a

disposal site for the first stage of investigation (literature search). When advertising publicly, NUMO distributed “documents for public advertisement” to municipalities nationwide, which describe safety assurance at high-level radioactive waste disposal sites, including ways to reduce the movement of radioactive substances by multi-barriers.

3. Securing understanding and trust of international society

In recent years, active discussions have been made in international society with regard to peaceful use of nuclear energy and nuclear nonproliferation, and it has become more and more important for Japan, which does not possess any nuclear weapons, to seek for international understanding of its peaceful use of nuclear energy. Japan has actively contributed to activities for safety of nuclear energy taken by international organizations for the purpose of promoting peaceful use of nuclear energy and nuclear nonproliferation.

(1) Application of Integrated Safeguards

Japan has acted positively toward early application of Integrated Safeguards, such as implementing “complementary access” that staff from IAEA are allowed to enter nuclear facilities on short notice in order to confirm that no undeclared nuclear substances or nuclear activities exist.

As a result, at the IAEA Board of Governors in June 2004, it was concluded that Japan’s nuclear activities have shown no signs of diversion of the nuclear substances under safeguards or of existence of undeclared nuclear substances or nuclear activities. From September 2004, Integrated Safeguards came to be applied to Japan’s nuclear activities.

Integrated Safeguards were first applied to a nation, like Japan, that implements nuclear activities on a large scale. This is one of the substantial results with great significance that will lead to acquisition of international understanding and trust of the fact that Japan’s nuclear utilization is strictly limited to peaceful purposes.

(2) Universalization of the Additional Protocol

Japan has actively promoted initiative for “Universalization of the Additional Protocol” in cooperation with IAEA.

Japan hosted the “International Conference on Wider Adherence to Strengthened IAEA Safeguards” in December 2002. One of the results was a release of the chairman’s summary statement that will be a guideline for universalization by consensus of participants from member countries. Japan also provided financial support for the “IAEA Safeguards and Nuclear Security Seminar” held in Vienna in February 2003.

Also at the “Asia-Pacific Nuclear Safeguards and Security Conference” in November 2004 and in the Ministerial Meeting of the fifth Forum for Nuclear Cooperation in Asia (FNCA) in December 2004, Japan called for early conclusion of the Additional Protocol to countries in the Asia-Pacific region.

(3) IAEA Director General Dr. ElBaradei's initiative and US President Bush's proposal

IAEA Director General Dr. ElBaradei publicized the International Nuclear Control Plan in the British magazine Economist (October 2003 issue). This plan aimed for multinational control of activities such as uranium enrichment, which is the technology to produce nuclear substances available for nuclear weapons, and spent fuel reprocessing, as well as international control and disposal of spent fuel and radioactive wastes.

In order to review this International Nuclear Control Plan, an international expert group was established in the IAEA, and the results are to be reported at the IAEA Board of Governors in March 2005. Japan shares the recognition that enhancement of the international nuclear non-proliferation system is an issue of urgency, but thinks that enough consideration should be made for peaceful use of nuclear energy at the same time as effectively enhancing the nuclear non-proliferation system.

US President George W. Bush made a proposal focusing on seven points (such as uranium enrichment, reprocessing equipment, and non-proliferation of technologies, etc.) in a speech he made at the National War College in February 2004. Among these, strategies for uranium enrichment, reprocessing equipment, and non-proliferation of technologies have been under discussion with other member countries of Nuclear Supplies Group (NSG).

(4) About physical protection

As for Japan's physical protection, business entities are required to take measures in accordance with international agreements such as "Treaty on Physical Protection" and Nuclear Reactor Regulation Law.

In December 2004, the Nuclear Disaster Prevention Subcommittee of the Advisory Committee for Natural Resources and Energy compiled a report that describes enhanced counterterrorism measures including an introduction of a physical protection inspector system, based on IAEA guidelines "Recommendations on Physical Protection" calling for preparation for a terrorist threat against nuclear facilities and on situations such as the September 11 terrorist attacks. MEXT has also been compiling a similar report "Safety Regulations of Nuclear Reactors for Experiment and Research (provisional)."

Based on these reports, MEXT, METI, and the Ministry of Land Infrastructure and Transport are planning to submit a bill to revise the Nuclear Reactor Regulation Law to the 2005 ordinary Diet[2].

(5) Information Transmission towards International Society

In August 2004, in response to the accident at Mihama Nuclear Power Plant Unit 3 (KEPCO), the government submitted the information on the accident to IAEA on the day of the accident, and as early as the next month, Mr. Motegi, the Minister of State for Science and Technology Policy explained the accident and reiterated Japan's determination for further improvement of safety at

[2] In May 2005, the bill to revise the law was enacted at the 2005 ordinary Diet.

the IAEA annual conference.

The Parliamentary Secretary for Foreign Affairs, Fukushima, attended the “Asia-Pacific Nuclear Safeguards and Security Conference” held in Sydney in November 2004, delivered the keynote address entitled “Benefits of strengthened safeguards,” held meetings with representatives from six countries and organizations, and emphasized the importance of international cooperation and domestic efforts for preventing nuclear terrorism.

Japan and Vietnam co-hosted the Ministerial Meeting of the fifth FNCA from November 30th to December 1st in Hanoi. Mr. Tanahashi, the Minister of State for Science and Technology Policy, attended the meeting and explained Japan’s efforts for peaceful use of nuclear energy and for attracting the International Thermonuclear Experimental Reactor (ITER) to Rokkasho, Aomori prefecture.

The disintegration of the Soviet Union caused growing concerns over safety of old Soviet nuclear power plants in the former Soviet Union and Central and East European countries. In 1992, the G7 Nuclear Safety Working Group (G7NSWG) was established under the framework of the F7 Summit as an international cooperation for nuclear safety. Japan has actively participated in this and has contributed funding to the “Nuclear Safety Account (NSA)” established in the same year.

Furthermore, Japan has actively transmitted information about its peaceful use of nuclear energy in order to win the understanding and trust of international society by emphasizing the importance of strengthened nuclear non-proliferation system and asking for the understanding in attracting ITER to Japan through bilateral talks and meetings with foreign dignitaries in nuclear energy policies.

4. Efforts by AEC to establish a new long-term nuclear energy plan

AEC considers that in making decisions of nuclear energy policy, it is important to listen to proposals and opinions from a wide range of experts and the public, find common principles and goals from them, evaluate proposed options of policies as quantitatively as possible, and clarify the grounds for deciding the policy. At the same time, in promoting research, development and utilization of nuclear energy, the practitioners should conduct risk management and fulfill their responsibilities for explaining the validity of management activities. AEC will also continue its efforts to evaluate the effects of the policy and review the policy and system, based on the latest knowledge and situations.

(1) Efforts concerning nuclear fuel cycle policy

As Fukushima Prefecture compiled an interim report at the Energy Policy Study Panel, questions on nuclear fuel cycle policy were raised from various standpoints. Therefore, AEC organized the “Panels Reviewing Nuclear Fuel Cycle Policy” to seek the opinions from mayors of the nuclear facility sites, electrical power suppliers, and journalists throughout the nation on what is required for restoring the public’s trust. Based on opinions proposed in this panel, AEC widely publicized “About Nuclear Fuel Cycle” to the public in August 2003, compiling the

importance of the past nuclear fuel cycle policy and AEC's attitude towards the present issues.

AEC also held an "Open Forum – Think about Nuclear Fuel Cycle" and a "Meeting to Talk about Nuclear Fuel Cycle," continuing discussions with the public on why nuclear fuel cycle is important for Japan's future energy policy.

(2) Discussion sessions with local residents

AEC established "Discussion sessions with local residents" in July 2001 in order to expand involvement of local residents in the process of establishing nuclear energy policy and to grope for ways to construct a relationship of mutual trust with the public. The sessions have been held nine times both at regions of nuclear facility sites, such as Aomori and Fukui, and at consuming regions, such as Tokyo and Osaka.

When misconduct concerning inspections and inspections by TEPCO occurred, AEC held sessions entitled "Is necessary information really prevailing?" in November 2002 and "What did the electricity crisis of this summer mean?" in October 2003 to gather opinions on staffs' awareness of the issues and how to restore trust.

Furthermore, AEC held sessions entitled "a Long-Term Nuclear Program" in March 2004 and "Nuclear fuel cycle policy," which had been under discussion at "New Nuclear Policy-Planning Council," in October 2004 to gather proposals and opinions on the topics widely from the public.

(3) For establishment of a new Long-Term Nuclear Program

AEC has established Long-Term Nuclear Programs to carry out policies related to Atomic Energy Basic Law according to plan, and has revised them approximately every five years since 1956. In November 2005, it will be five years since the current Long-Term Nuclear Program was established.

AEC declared that it would initiate preparatory activities to discuss and decide a new Long-Term Nuclear Program and ways to carry it out in its "New Year Policy Statement," which was compiled in January 2004. As a part of it, AEC decided to hold "Opinion Hearings on the Long-Term Nuclear Program" to gather proposals and opinions widely from the public. Raised opinions were reported at regular meetings of AEC and were submitted as references to "The First Round of New Nuclear Policy-Planning Council."

In June 2004, AEC reached a conclusion that it would be appropriate to start discussions to complete a new Long-Term Nuclear Program within 2005, compiling proposals and opinions widely raised from the public.

It was decided that "New Nuclear Policy-Planning Council" would be established in AEC and discussion would be held publicly for the conclusion. "New Nuclear Policy-Planning Council" decided to start with evaluation concerning nuclear fuel cycle polices among various issues to be discussed on a Long-Term Nuclear Program, and for discussion, virtually set up four basic scenarios – full reprocessing, partial reprocessing, full direct disposal and temporary storage – to make comparisons among these scenarios, conducting comprehensive evaluation from ten viewpoints such as safety assurance and economical efficiency, etc.

While holding “New Nuclear Policy-Planning Council,” “Hearings on a Long-Term Nuclear Program” were held three times (Tokyo, Aomori, and Nagoya). Furthermore, based on discussions on nuclear fuel cycle policy at “New Nuclear Policy-Planning Council,” “The Ninth Discussion Session with Local Residents” was held in Osaka on this theme.

As a result of such comprehensive evaluation, AEC compiled “an Interim Report on Nuclear Fuel Cycle” in November 2004, and will carry out discussions on “safety assurance,” “nuclear power generation,” and “FBR cycle technology,” etc. related to nuclear facilities sequentially from now on[3].

AEC plans to continue gathering opinions widely from the public and to finish compiling the whole program within 2005.

5. Securing understanding and trust in the future

(1) Efforts by the concerned parties for securing understanding and trust

Activities concerning research, development and utilization of nuclear energy are carried out on various levels, such as R&D activities, to create new knowledge, industrial activities under market-based mechanisms, policy-making stages by the government, and international political economic fields. Nuclear energy policy is a program that enables social functions expected for these activities related to utilization of nuclear energy to actually play their rolls on each level.

In order for these programs to produce actual results, there should be an understanding in the society that social functions expected for activities related to utilization of nuclear energy are not only necessary and effective but also acceptable from the viewpoint of the systems and practices that had historically been formed in the society. When there are any accidents, breakdowns or misconducts in nuclear-related activities, the parties concerned are required first to disclose the fact accurately and immediately, clarify the responsibilities, seriously review the operation system, which is supposed to be maintained free from such problems, and establish preventive measures. By explaining these to people influenced by nuclear-related activities such as local residents and governments, the concerned parties engaged in these activities should be newly accepted as fully reliable by the society.

For this purpose, government-related organizations and private entities have carried out multilateral PR activities to win better understanding.

As for problems that had harmed public trust, it is extremely important to provide the public with all information related to countermeasures including preventive measures as a system, as well as information related to investigations of causes, comprehensibly through the most appropriate media, and to make efforts to restore trust with a humble attitude to make better countermeasures with the public, paying due consideration to their opinions.

In constructing trust for new projects, it is required to win public understanding that the

[3] AEC sorted out ten issues such as “nuclear fuel cycle policy,” “safety assurance,” “nuclear power generation,” “FBR cycle technology,” etc. and gathered opinions on the “Structure of the New Long-Term Nuclear Program (provisional)” in June 2005. Based on these, a draft of a new program (Nuclear Policy Outline) was completed in July 2005.

activities are based on the Long-Term Nuclear Program and the parties responsible for the operation have appropriate risk management capabilities. Therefore, it is important to provide the public with adequate information necessary for this and to carry out activities to win mutual understanding.

Efforts should be further strengthened to win more crucial understanding and trust of foreign countries that Japan has and will continue to use nuclear energy in a limited scope exclusively for peaceful purposes through its activities enhancing peaceful use of nuclear energy and nuclear non-proliferation in international society.

AEC will strive continuously to provide multiple options related to the policy and system based on deep insight of public expectations, to show their advantages and disadvantages as quantitatively as possible, to attach great importance to PR activities for asking for public participation in the decision-making process, to gather opinions from the public through gatherings and hearings, and to try to win wide mutual understanding among the public on the policy established in this way.

When accidents harm public trust regarding the concerned parties in implementing projects based on the Long-Term Nuclear Program, or when starting a new project, the concerned parties are naturally supposed to make efforts to win public understanding of the project's validity, and at the same time, AEC will host briefing sessions as occasion demands, and provide adequate support to activities indispensable in this area by specialist groups such as related academic associations.

Nuclear energy has been utilized not only for power generation. Radiation has been utilized widely in medical treatments, industry, agriculture, and for development of high-tech science, and has contributed to the enhancement of people's welfare and quality of lives. AEC anticipates that PR activities will widen public interest and understanding on promotion of such R&D and utilization of nuclear energy are to be carried out on responsibility of related academic associations as well as the concerned parties.

Furthermore, AEC will take every opportunity to win understanding of the international society on Japan's peaceful use of nuclear energy as a nonnuclear country widely performing nuclear activities, and will continue positive efforts to resolve an international problem of nuclear non-proliferation, making much of opportunities like IAEA and FNCA.

(2) Future problems

Considering recent circumstances home and abroad, attention should be paid to the following points for future efforts.

First, safety assurance should again be noted as a major premise in nuclear-related activities. People were deeply hurt by the serious industrial accident in the operating nuclear power plant that caused a number of casualties. Various efforts have been made to heal that emotional trauma, however, public trust has not yet been restored in activities for research, development and utilization of nuclear energy. Therefore, while maintaining condolences for the deceased and keeping sympathy for their families deep in mind, it is required to introspect again that the

highest priority is given to safety assurance in activities for research, development and utilization of nuclear energy, for which public understanding are indispensable.

Second, activities for research, development and utilization of nuclear energy can greatly contribute to the resolution of global issues such as energy security and global warming, but for an effective performance of such activities to be achieved for these issues, the government needs to take measures for appropriate and effective research, development, regulations and guidance, so that public expectations for resolution of these issues should be precisely reflected as market conditions to the market where economical efficiency in narrow meaning is emphasized in choosing energy technologies. For example, as was mentioned above, for the sustainable existence of nuclear-related activities, activities and countermeasures for safety assurance are indispensable, and for maintaining these activities in the market, security regulation system should be such that business entities can establish effective quality assurance systems and develop original risk management activities under effective controls by the government based on clear safety assurance principles.

Third, as is clear in descriptions so far, in order to construct public understanding that the people carrying out nuclear-related activities can be trusted, and to make nuclear-related activities accepted by the relevant local communities, PR activities by the concerned parties are indispensable, setting safety assurance as a major premise. For organizing opinions of the local communities, local authorities are playing a major role. Under the present circumstances where discussions have been developed on decentralization of power, the government, which is responsible for promoting nuclear energy policy, and local authorities are required to acknowledge their own rolls and cooperate with one another for winning mutual understanding between the concerned parties and the local communities, being aware of the significance of energy problems which require long-term efforts and have a great influence on the public good. Therefore, the concerned parties need to enhance their efforts to maintain the effectiveness of this cooperative relationship, which is indispensable for nuclear-related activities, also in a new environment.

Furthermore, strengthening of protection systems for nuclear energy facilities and nuclear materials is required in response to the recent international trend toward stricter protection of nuclear materials, which was triggered by the 9/11 terrorist attacks. The government and business entities should also continue organizing countermeasures against terrorism to nuclear energy facilities and nuclear fuel materials as a part of countermeasures against military attack situations, based on the G8 Agreement on trade control of high-risk radioactive sources and on guidelines set forth by IAEA. In this process, it is internationally required not to disclose vital information to the public as a part of these countermeasures. Therefore, from a viewpoint of winning better mutual understanding with the public on safety assurance, when organizing the system, it is important to fully explain the significance of the system to the public, making it clear that certain information should not be disclosed for safety assurance.

Chapter 2: The State of research, development, and utilization of nuclear energy in Japan and around the world

Section 1: Nuclear energy policy in Japan

(1) Nuclear energy policy in Japan

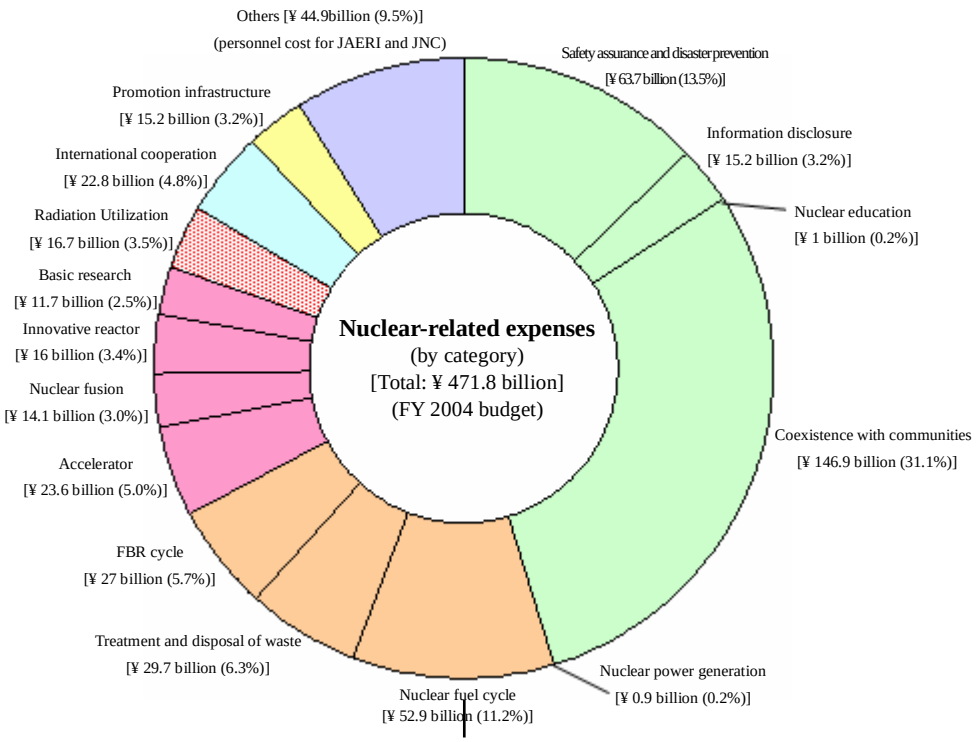
The Atomic Energy Commission of Japan (AEC) and the Nuclear Safety Commission of Japan (NSC) were established in the Cabinet Office to make plans, hold discussions, and make decisions on research, development, and utilization of nuclear energy. Based on this, operations for promotion and regulation on science technologies are carried out by MEXT, on energy by METI, and on nuclear diplomacy by the Ministry of Foreign Affairs.

(2) Activities of the AEC

AEC started hosting the "Opinion Hearings on the Long-Term Nuclear Program" in January 2004 to gather opinions widely from the public on the whole concept and the establishment of the Long-Term Nuclear Program, and in June 2004 it started to establish the new program based on these results, aiming for completing the task within 2005.

AEC investigates and discusses important issues related to nuclear energy, and then complies and discloses the results as decisions, statements, or opinions of the Committee. With regard to FY2004 budget, it compiled "About Plans concerning Research, Development and Utilization of Nuclear Energy, FY2004" in March 2004.

Figure 2-1　Nuclear-related Expenses (by category)



(3) Establishment of Japan Nuclear Energy Research and Development Institute

In December 2001, it was decided that the Japan Atomic Energy Research Institute (JAERI) and the Japan Nuclear Cycle Development Institute (JNC), which had played the core role in Japan's nuclear energy R&D activities, would be merged into a new independent administrative institution. And in October 2004, the Act for the Japan Nuclear Energy Research and Development Institute was enacted.

The government, JAERI and JNC are required to promote the preparation for the establishment of the new institution, which is scheduled to be completed in October 2005.

Section 2: Harmony between People, Society and Nuclear energy

(1) Safety assurance and disaster prevention

The government is responsible for exercising strict safety regulations from the viewpoint of securing lives and properties of the people. The government is required to monitor business entities' compliance with safety regulation based on the Nuclear Reactor Regulation Law, which was strengthened due to the criticality accident at JCO's uranium-processing plant in Tokaimura.

On the premise that it is impossible to completely eliminate the probability of accidents, it is necessary that the government, local governments, and business entities should seek the understanding of local residents and that they should cooperate with one another to secure the effectiveness of the Special Law of Emergency Preparedness for Nuclear Disaster.

For safety assurance of nuclear facilities, AEC and NSC independently investigate and discuss applications for permission of nuclear facility establishment (alteration), while there are regulations by the Ministers of MITI and MEXT (so-called double check). Furthermore, NSC investigated and held discussions for the establishment of the new safety research plan and completed the "Prioritized Plan for Nuclear Safety Research" in July 2004. Related ministries, agencies and independent administrative institutions have conducted investigations of spontaneously emitted radiation and radioactivity around nuclear facilities, and the results have been made into a database available on the Internet.

(2) Information disclosure and information supplement

Information on nuclear energy is the basis for the public to evaluate the reliability of nuclear official and business entities. Therefore, the government and business entities should disclose appropriate and reliable information demanded by the public on a timely basis, and they have actually promoted information disclosure in a positive manner. The government has also tried hard to take in public opinions in the process of policy-decision.

Furthermore, various efforts, including "Discussion sessions with local residents" and "Panels Reviewing Nuclear Fuel Cycle Policy," have been made to construct national consensus. PR activities on energy policy, including nuclear energy, have also been developed based on the four basic principles, such as enhancement of future energy education for the public.

(3) Education concerning nuclear energy

Education concerning nuclear energy should be considered systematically and comprehensively as a part of energy education and environment education, from the viewpoint of understanding scientific technologies and radiation. It would be effective to utilize "integrated study periods" which was newly introduced in the new school

curriculum guideline as well as to enrich learning on energy and nuclear energy.

Efforts have long been made to enhance teaching on energy and nuclear energy in school education and the new school curriculum guideline further emphasizes the importance of the enhancement. MEXT operates the system of "Subsidy for Education Assistance Business concerning Nuclear Energy/Energy," which grants budgets necessary for creation and purchase of supplementary materials. Furthermore, METI distributes pamphlets collecting case examples of energy education to each school and organizes designated schools for practicing energy education.

(4) Coexistence with communities hosting nuclear facility sites

For smooth selection of a site for nuclear facilities, the public – power consumers – should deepen their understanding for power source siting based on appropriate understanding of the current state of energy problems in Japan. For this purpose, the government and business entities need to enhance mutual exchange activities between those at nuclear facility sites and those at power consuming areas, which are provided with electricity by nuclear power generation.

For enhancing measures to develop nuclear facility sites, three laws on power-source siting have been strengthened, and in a substantial expansion in October 2003, industrial development and personnel training were newly added to the objects of the subsidiary. Activities for coexistence with communities have been carried out not only by the government, local authorities, and business entities but also by organizations that transmit information on nuclear energy and energy problems on a national basis and by organizations that work for deepening understanding for nuclear energy in communities holding nuclear facility sites and for realizing coexistence with nuclear-related industries.

Section 3: Nuclear Power Generation and the Nuclear Fuel Cycle

(1) Steady development of nuclear power generation

Nuclear fuel cycle further improves the special property of nuclear power generation, which is superior in stability of supply, and the promotion of nuclear fuel cycle is the very basic policy of Japan.

In order for nuclear power generation to keep on playing its expected roll, the government and the private sector need to tackle the development of technology preparing for the appearance of new value or environmental restriction, and to positively introduce technological performances effective for enhancing Japan's energy supply system.

Japan's self-sufficiency ratio of energy supply is as low as 4% on hydro and geothermal power (20% when adding nuclear energy which has high stability of supply), which is rather low compared with ratios in Western countries. The "Energy Basic Plan" suggests promotion of nuclear power generation, including nuclear fuel cycle on the premise of safety assurance, as basic power source because nuclear energy has excellent properties in terms of stability of supply and as countermeasures against global warming. The "Guideline for Measures to Prevent Global Warming" positions nuclear energy, along with new energy, as measures to reduce CO_2 emissions in supplying energy.

At present, 52 commercial nuclear reactors in Japan are operating with generation capacity of 45.742 million kW, which is the third largest in the world following the United States and France. Throughout the world, 434 nuclear reactors were operating as of December 2003 with generation

capacity reaching 376.286 million kW, and supplying 2600 billion kWh of electricity, which accounts for approximately 16% of the total amount of electricity in the world.

Table 2-1 Nuclear Power Generation Facility Capacity in Japan (As of the end of December 2004)

	Units	Total Capacity (Gross Electric Power)
Operating	52	45.742 million kW
Under construction	5(4)	5.03 (4.75) million kW
Preparing for construction	12	16.318 million kW
TOTAL	69(68)	67.09 (66.81) million kW

Figures in the parenthesis exclude nuclear reactors in the R&D stage.

(2) Uranium enrichment and forming process and reconversion of nuclear fuel

It is important for Japan to improve the stability of supply of enriched uranium and the independence of nuclear fuel cycle. In order to ensure international competitiveness of Japan's enrichment technology, it is also important to continue promoting domestic research and development, considering that this technology is highly advanced and sensitive.

Japan Nuclear Fuel Limited (JNFL) is now producing 600 ton SWU/year at the Rokkasho uranium-enrichment plant. JNFL, established the Uranium Enrichment Technology Development Center in November 2000, has developed an advanced centrifuge.

(3) Utilization of MOX fuel in light water reactors (named "Pluthermal")

Pluthermal is an alternative method for fuel supply related to nuclear power generation, as well as the technology for effective utilization of uranium resources. It is useful for improving stability of fuel supply, and will also contribute to the development of industrial infrastructure and social environment, preparing for a full-scale recycling age in the future in the area of nuclear fuel cycle.

In Japan, the Japan Nuclear Cycle Development Institute (JNC) has led research and development for MOX fuel fabrication in Fast Breeder Reactors (FBR). Plutonium recovered by reprocessing in foreign countries will basically be fabricated to MOX fuel in Europe and is to be used in light water reactors in Japan.

(4) Reprocessing of spent fuel in light water reactors

In Japan, spent fuel in light water reactors has been reprocessed at the Tokai Reprocessing Center in the Tokai Works (JNC) and also consigned to overseas entities for reprocessing. Meanwhile, private business entities planned the Rokkasho Reprocessing Plant and have been carrying out the construction, aiming to start operation in 2006.

Research and development for reprocessing technology in Japan has been conducted at JNC, the Japan Atomic Energy Research Institute (JAERI)[4].

[4] As of March 2005, start of operation was rescheduled to 2007.

(5) Intermediate storage of spent fuel

Intermediate storage of spent fuel enables time adjustment during the period until the spend fuel is reprocessed, and is important as a measure to add flexibility to overall operation of nuclear fuel cycle. In Japan, legal systems concerning intermediate storage were developed in 1999, and private business entities are now preparing to begin operations by 2010.

(6) Treatment/conditioning and disposal of radioactive wastes

Most of the radioactive wastes are generated from nuclear power plants or nuclear fuel cycle facilities (including those reprocessed and returned from consigned foreign entities), but some of them are generated from universities, laboratories, and medical facilities. Basically, those who generate radioactive wastes should be responsible for safe and appropriate treatment/conditioning and disposal, and the government needs to take necessary actions to guide and regulate those responsible persons.

Most of the low-level radioactive wastes from nuclear power plants have been put underground, and the basic concept of treatment/conditioning and disposal for other radioactive wastes has also been clarified.

High-level radioactive wastes are supposed to be vitrified and passed on to geological disposal. Relevant organizations such as the government, the Nuclear Waste Management Organization of Japan (NUMO), and electrical power companies have actively disclosed and provided information on their websites based on the Final Disposal Act, and have carried out activities to promote public understanding, appealing for the need of disposal by holding symposiums and forums all over Japan. NUMO initiated a public appeal nationwide in December 2002 in order to conduct a first-stage investigation (literature search) to select a site for disposal. Furthermore, research on treatment/conditioning and disposal of high-level radioactive wastes has been carried out at facilities such as JNC.

International discussions have been held on disposal of radioactive wastes and the Committee on Radioactive Waste Management (CoRWM) of the Organization for Economic Cooperation and Development / Nuclear Energy Agency (OECD/NEA) has carried out activities with regard to overall management of wastes concerning environment and safety, etc.

(7) FRB cycle technology

FRB and related nuclear fuel cycle technology, once put to practical use in the future, will create the possibility to continuously utilize nuclear energy for hundreds of years with currently available technology and economically usable uranium resources, and to further reduce the environmental burden by cutting down radioactive waste that remains at a high-level radioactivity for a long period of time. Therefore, they should be steadily developed from the viewpoint of securing an effective option for future energy for an unpredictable future.

Prototype Reactor Monju is the only FBR plant in Japan, but it has been out of operation since the leakage of secondary sodium coolant, which occurred in December 1995. JNC has been carrying out a “Feasibility Study” to present an appropriate commercialized image of FBR cycle technology and an R&D plan to realize that.

(8) Foreign trend concerning nuclear fuel cycle

France and England, etc. have shown a positive attitude towards nuclear fuel cycle for promoting peaceful use of nuclear energy, while the United States, Canada and Sweden, etc. have shown a negative attitude.

(9) Advanced thermal reactor

Advanced thermal reactor Fugen terminated its 25-year-long operation in March 2003, but research and development will be continued for decommissioning.

Section 4: Diversified Development of Nuclear Science and Technology

Science and technology in general have two aspects – basic research based on so-called intellectual curiosity and R&D for application responding to the needs of the economy, society and people, as does nuclear science and technology. It is important to organize an environment that nurtures creative research and to effectively promote research and development, maintaining a good balance with supportive basic and generic research.

(1) Accelerators

Plans for high-intensity proton accelerators, which will be an effective measure to search material origin, elucidate life functions, and create new materials, will be promoted appropriately in accordance with the evaluation conducted jointly by AEC and the Science Council, and the RI Beam Accelerator Facility (RI Beam Factory) will be steadily constructed. As plans for high-intensity proton accelerators in general are always locked in international competition and are technology-driven, it is important to reflect the evaluation results, without delay, after proposals or evaluations are conducted.

AEC established the Panel Reviewing Accelerators under the Special Committee on R&D, and in April 2004, they publicized the report "The Present and the Future of Accelerators," compiling introductions of areas utilizing accelerators, evaluation and problems of the major four accelerators, and its recommendations on future construction of accelerators and R&D using accelerators. For utilization of accelerators, they are conducting cellular analysis applying ion beams, and are utilizing radiation light that can be an effective research measure for a wide range of basic research on material science etc.

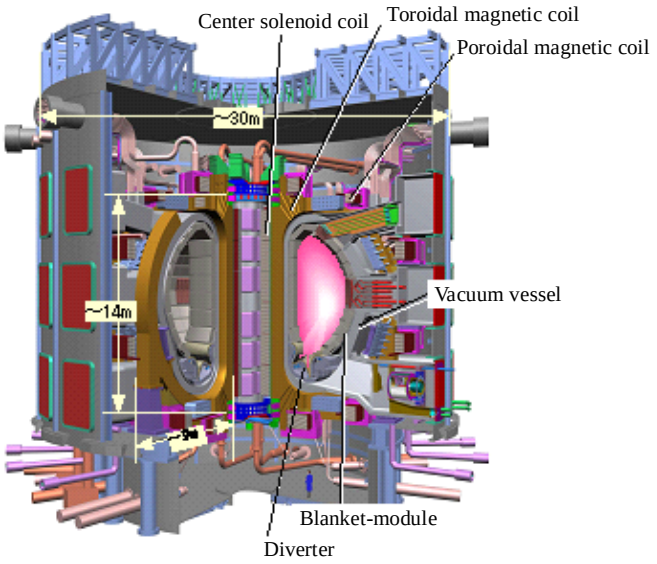
(2) Nuclear fusion

R&D for nuclear fusion should be promoted from the viewpoint of enlarging options of future energy and enhancing their feasibility. Realization of nuclear fusion combustion and comprehensive tests of nuclear fusion reactor engineering are the major issues to be resolved in the future. The International Thermonuclear Experimental Reactor Project (ITER) is important from this viewpoint.

In Japan, R&D for nuclear fusion has been conducted at JAERI and universities according to the "Third Stage Basic Plan for R&D for Nuclear Fusion" made by AEC. As for the ITER Project, Japan has been cooperating and continuing talks with related countries under the hexagonal framework to successfully attract the facility to Japan[5].

[5] At the hexagonal ministerial-level meeting on June 28th, 2005, Cadarache, France was selected as a construction site and Japan secured the position as a quasi-host country. Six parties reached an agreement of implementation of the ITER Program by mutual cooperation.

Figure 2-2 Outline of ITER



Major Data

Nuclear fusion output: 0.5 million kW*1
Plasma main radius: 6.2m
Plasma minor radius: 2.0m
Plasma current: 5 million A*2

*1: operational until 0.7 million kW

*2: operational until 1.7 million A

(3) Innovative nuclear energy system

In the 21st century, innovative nuclear reactors as well as next-generation light water reactors, which are extremely economically efficient and safe and are suitable for various methods of supplying energy including heat utilization and for diffusion of nuclear reactors, are expected. The government, industry and universities are required to cooperate with one another in R&D for innovative nuclear reactors.

Internationally there are two major activities undertaken by the Generation IV International Forum (GIF)[6] and the International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO). In Japan, R&D for various innovative nuclear energy systems has been conducted at private, university and national research institutes, and MEXT and METI have been implementing open-type research systems.

Basic research on nuclear science and technology brings out various potential for nuclear energy and creates seeds leading to future technological innovation. The government needs to promote such research through considering utilization of competitive funds, making much of researchers' originality, and performing an appropriate evaluation.

(4) Basic and generic research

Basic and generic research supporting nuclear energy covers a wide range of areas from physics and chemistry to medical science and life science, and has been promoted at independent administrative institutions and universities. At various national laboratories and independent administrative institutions backed by relevant ministries, they have been conducting "advanced generic research" on four generic technologies including materials and effects on living organisms and environments according to administrative needs, and

[6]The fourth generation nuclear energy system: The nuclear energy system following the first generation (early prototype reactors), the second generation (PWR, BWR, and CANDU reactors), and the third generation (ABWR, AP600, and EPR). It is scheduled to be put into practice in around 2030.

“comprehensive research” in a top-down style by AEC.

Section 5: Utilization of Radiation Contributing to People’s Lives

Radiation, if mishandled, can be a dangerous tool harming good health. With appropriate management, however, it can bring about significant benefits and vitality to society. Therefore, it is important to win public understanding by providing clear information and actively promoting information disclosure, and to diffuse utilization of radiation by promoting R&D for improving availability in wider areas such as medical care, industry, and agriculture.

Diffusion of radiation utilization increases facilities and opportunities to deal with radiation and radioactive materials. Therefore, appropriate management of the generation of radioactive wastes (including their disposal), and enhancement of educational training on physical protection is indispensable.

(1) Contribution to people’s lives

Treatment facilities utilizing high-energy protons were established recently in several parts in Japan and utilization of radiation for medical care has become quite common. Radiation has been widely used for diagnostic imaging technique and X-ray CT tomography, and research has been conducted for diagnosis with less dosage, which has contributed significantly to public health. In the agricultural area, radiation has been used for breed improvement, insect pest control, and food irradiation. Radiation has also been used in the areas such as industry and environment conservation.

(2) Research on ecological effects of radiation and radiation protection

Basic research should be promoted comprehensively on effects of low-dose radiation on the human body, using various methods such as an epidemiologic study, while research on high-dose radiation exposure should be focused on medical care.

The National Institute of Radiological Sciences (NIRS), as the core organization of emergency medical system for radiation exposure, has worked hard to establish a medical system/support system for an emergency, and has conducted research on the radiation mechanism that causes ecological effects. JAERI has conducted research on more rational radiation protection based on a scientific basis and has managed environmental radiation and institutional radiation.

(3) Improvement of environments for radiation utilization

In order to improve the quality and the quantity of engineers supporting radiation utilization, relevant organizations need to cooperate with one another for effective human resource development. Furthermore, it is important to enhance supportive basic and generic research and to put the results into practice by utilizing the technology transfer system.

MEXT has held seminars on radiation utilization technology, dispatched specialists, and implemented technical training from the viewpoint of developing human resources related to radiation utilization at local R&D organizations. JAERI has promoted research and development for space and advanced materials such as nuclear fusion reactors utilizing large-scale irradiation facilities and various accelerators.

Section 6: Harmony between International Society and Nuclear Energy

For smoothly implementing peaceful use of nuclear energy, efforts for nuclear non-proliferation are extremely important. The government will tackle maintaining and enhancing various international frameworks, such as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and the IAEA's comprehensive safeguards, physical protection, and the Comprehensive Test Ban Treaty (CTBT) based on the NPT, as well as work on improving he transparency of Japan's utilization of plutonium.

Japan has constructed close cooperative relationships with six nations, including the United States, by signing bilateral agreements on cooperation on nuclear safety and R&D, and has actively provided cooperation internationally, including joint R&D activities with foreign countries, support for nuclear energy development in Asian countries and developing countries, and support in the areas of nuclear energy safety and denuclearization in the former Soviet Union and Eastern European countries.

In the United States and some other countries, there are movements towards construction of new nuclear power plants and disposal sites of high-level radioactive wastes. In Asia, nuclear power plants are under construction in South Korea, etc.

Section 7: Foundation to Promote Research, Development and Utilization of Nuclear Energy

In order to further promote development and utilization of nuclear energy in Japan, it is important to nurture and secure excellent human resources, to raise funds, to clarify the division of the roll by each R&D organization, to develop closer ties among them, to revitalize research activities, and to promote research comprehensively on a schedule covering a wide range from basic research to R&D application.

Universities play the core role in nurturing and securing nuclear-related researchers and engineers, while engineers and technicians for nuclear power plants are basically trained by the private sector. JAERI and JNC have provided cooperation for graduate education mainly based on the systems of partner graduate schools to nurture human resources in the nuclear-related area. Furthermore, the "Nuclear Energy/Radiation" sector was newly established in the Professional Engineer System[7] since the Professional Engineer Test of FY2004.

Research and development has been promoted comprehensively on schedule, ranging from basic research to application stage, as each R&D organization divides their responsibility.

The nuclear equipment supply industry, which supplies nuclear equipment and services, is expected to maintain and improve its technology, to development capability and to mature into an independent as well-balanced compound industry.

[7]Professional Engineer System: The MEXT-backed national certification established based on Professional Engineer Act (enacted in 1967 and fully revised in 1983), which aims for contributing to the advancement of science and technology and the development of national economy by granting certification as a "Professional Engineer" to a person with capabilities to conduct planning, research, and designing of matters that require advanced professional applied skills concerning science and technology.