FNCA workshop of project on HRD

Status and prospects of atomic energy application in viet nam

Prof. Vuong Huu Tan
President of the VINATOM

Hanoi, November 15th 2011

CONTENTS

Status of atomic energy application in Vietnam

- Application of radiation energy
- Research and Development of Nuclear Power

Strategy of atomic energy application up to 2020

1. Development Orientation of atomic energy application
2. Steering Outlook
3. Objectives
4. Strategy Content
5. Implementation Solution

Strategy Implementation

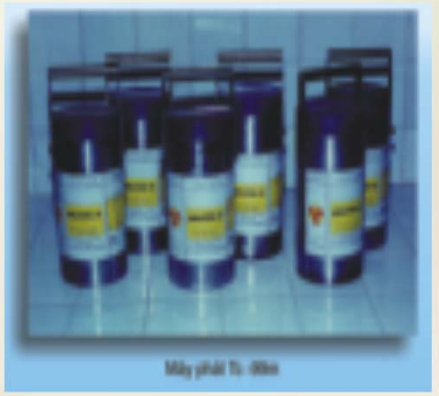
Conclusion

Application of radiation energy

1. In the Medicine

- Radioisotopes have been produced at Dalat Nuclear Research Reactor providing the Medicine with 150-200 Ci with over 20 kinds of radioisotopes and radiopharmaceuticals, mainly including productions of I-131, P-32, Tc-99m, Cr-51,..
- Recently, Cyclotron Centers at Cho Ray Hospital, 108 Hospital and Institute for Nuclear Science and Technology have been producing radioisotopes for PET and SPECT.
- The current demand is 300-400 Ci. Ir-192 and Co-60 for treatment have been completely imported with around 1000 Ci/year.

Production of Radioisotopes at Dalat NRR



The Tc-99m Generator

Application of radiation energy (cont)

Radiotherapy

- Total: 20 radiotherapy facilities
- RT Equipments: 12 Co-60 Units, 11 LINAC, 22 Brachytherapy, 3 Gamma Knife, 1 Cyberknife and 12 Simulators.
- About 20.000 cancer patients are treated by RT technology each year.
- Staff at RT facilities: 2000 people
- Early Cancer Screening and Detection have been implemented at pilot level for cervical cancer and breast cancer in some provinces.

Maintenance of Co-60 at K Hospital

Application of radiation energy (cont)

Nuclear Medicine

- **Total: 25 facilities of Nuclear Medicine**
- **Diagnostic Equipments: 20 units of gamma scanner, gamma camera, SPECT, SPECT/CT; however, only 10 units are in operation. Recently, 4 PET/CT have been added and 3 Cyclotron Centers have been put into operation.**
- **Diagnosis of diseases such as cardiovascular, endocrine, digestion, cancer...**
- **Treatment of thyroid cancer**
- **Each year, about 500.000 people are diagnosed and 50.000 people are treated by Nuclear Medicine.**

Application of radiation energy (cont)

X-Ray

- The System of X-Ray Departments has been formed from central hospitals to local hospitals.
- There is a shortage of X-Ray equipments and most of them are old, especially X-Ray interventional equipments. There are no means of computed tomography (CT), color ultrasound system, nuclear magnetic resonance (NMR) in many local hospitals.
- Training and Standardization for the staff face many difficulties.
- Steering in Healthcare has not been implemented well because it lacks a net work from national and regional center to hospitals.

Localizing equipments and products

- Localizing equipments and products for promotion of radiation application in Medicine has not achieved many results.
- Some products and equipments have been transferred to Viet Nam such as brachytherapy system, bilayer system, diagnostic and treatment equipments using Laser Technology and nuclear magnetic resonance (NMR).
- Sterilization of medical equipments by irradiation technolgoy has been utilized.

Application of radiation energy (cont)

2. In Agriculture and Biology

- For 30 years, 50 breeds of 5 kinds namely rice, soybean, peanut, daisy and apple have been created including 32 breeds of rice and 10 breeds of soybean. Vietnam is ranked 8th in the world in the field of mutation breeding by radiation. VN-95-20 is one of 5 main exported breed planted over 0.3 mil ha/ year. 3 main breeds of soybean are DT84, DT 9, DT96 occupying 50% of cultivated area.
- Sterile Insect Technique (SIT) for harmful fruit fly has been researched and experimented in safe vegetable production.

Application of radiation energy (cont)

- **Research on soil erosion and lake bowl sediment by measurement technique of Cs-137, Be-7 and Pb-210**
- **Create some products of growth simulation and plant protection by radiation technology...**
- **Research and utilize Irradiation for food preservation and quarantine**

Study sediment at river mouth

Microoganism fertilizer

Application of radiation energy (cont)

3. In industry and other socio-technical sectors

- **Non Destructive Technique (NDT) has been applying in checking and assessing buildings, equipment systems (pipe conduit, boiler, vessel,…), checking goods, ensuring security at border gates. Now, using this technology becomes compulsory requirement in quality inspection of constructive building and transportation.**

Checking shortcomings of My Thuan bridge

Application of radiation energy (cont)

- Automatic nuclear control technology has been used in controlling production assembly to check pure level of fresh water companies; measure thickness level plastic, paper, corrugated iron…in correlative companies; measure batch stone in cement, glass companies to ensure the quality of products.

- Borehole Logging Technique uses radioactive resource to research petrology, air- void ratio, natural radioactive level and flow to serve for the exploration and exploitation of gas & oil.

Application of radiation energy (cont)

- Isotope tracer technique is used to optimize technological process in many companies and production line. Recently, this technology has been used effectively in field of Petroleum and gas complex to inspect mines and research movement of water in exploitation process to optimize exploitation process,

Application of Isotope tracer technique at Bach Ho mine

Application of radiation energy (cont)

- Although radiation technology accounts for 90% of world economy's portion, it still limits in Vietnam. There are only 4 facilities of industrial irradiation nationwide.
- There virtually doesn't exit equipment production and development serving the application of radiation in industry.

Application of radiation energy (cont)

4. In geology, hydrology and environment

- Exploration and assessment of mineral reserves uses techniques of borehole logging carota, radiation measurement in air and nuclear analysis…
- Research and assessment of reserves, age, origin, additional level, pollution, salinity groundwater resource in Ho Chi Minh city, Ha Noi city and some provinces in the South.
- Research on infiltration through dam to assess safety of dam
- Organize environmental radiation observation. Now, 3 national monitoring stations has established an initial database on environmental radioactive background in Vietnam
- Research on environmental pollution uses nuclear analytical techniques and isotope tracer technique.

Application of radiation energy (cont)

5. General comments on radiation applications

- **Radiation application has been implemented in many fields.**
- **Low level and effectiveness not fulfilling the potential and meet the demand.**
- **Thus, the Prime Minister has issued the Strategy for Application of Atomic Energy for Peace up to 2020, the Master Plan and Detailed Schemes of Development of radiation applications with the aim to promote and enhance the effectiveness of radiation applications in socio- economic development.**

RESEarch & DEVELOPMENT of NUCLEAR POWER

1. Achievements

- **The need and feasibility of nuclear power has been confirmed**

- **Arguments around the need of NP development in Viet Nam not only base on factors such as: the primary energy source doesn't meet the demand or difficulties in energy import but also on other factors namely sources diversity to meet the demand of national food security, limitation of using fossil fuels, especially coal contributing to protect the environment and enhance the national science & technology potentials.**

RESEarch &DEVELOPMENT of NUCLEAR POWER (CONT)

- It is affirmed that Viet Nam has a resource of uranium. However, further research must have been conducted to elaborate the policy for commercial exploitation of this resource.
- Establish the international cooperation relation in NP field
- Propagannda and Public Infomation for NP Development have been organized frequently and efectively. Training Program has been built up and implemented. At the first phase, some officials have been trained to undertake important tasks in NP Development Program

RESEarch &DEVELOPMENT of NUCLEAR POWER (CONT)

- According to the pre-feasibility study, the first unit will be put into operation in 2020.
- By 2025: The total capacity of nuclear power plants will be about 8.000 MW, accounting for approximately 7% of the total electricity output.
- By 2030: The total capacity of nuclear power plants will be about 15.000 MW, occupying around 10% of the total electricity output.
- 10 potential construction sites for the NPP have been preliminarily determined in which 8 sites have been marked off.
- The selected site for the 1st NPP project is Phuoc Dinh and Vinh Hai , Ninh Thuan Province. Each site is expected to build 4 turbin units with the capacity of 1.000 MW.

Some potiential construction sites for NPPs

May 2009

18

RESEarch &DEVELOPMENT of NUCLEAR POWER (CONT)

2. Ninh Thuan Nuclear Power Project

- Ninh Thuan NP Project includes: Ninh Thuan 1 NPP (Phuoc Dinh) and Ninh Thuan 2 NPP (Vinh Hai) with total capacity of 4.000 MW, each NPP is 2.000 MW. Technology: Light Water Reactor.
- In July 2009, the National Appraisal Board approved the Investment Report (Pre-feasibility Report) for the Ninh Thuan 1 NPP Project.
- On 25 November 2009, the National Assembly has approved the proposal for construction of the first nuclear power plant in Ninh Thuan.
- The investment project (FS) will be implemented in 2-3 years.
- The Investor has applied for Licence 2012.
- Tender and conclusion for EPC Contract (Engineering, Procurement and Construction) will be carried out in 2013.
- The NPP Construction is expected to start in 2014

RESEarch &DEVELOPMENT of NUCLEAR POWER (CONT)

- **NPP Ninh Thuan 1**
  - **Phuoc Dinh,**
  - **Ninh Phuoc**
- **NPP Ninh Thuan 2**
  - **Vinh Hai,**
  - **Ninh Hai**

Strategy for application of Atomic energy up to 2020

- ***Orientations for Development of Atomic Energy Application in Vietnam***

  - **Promote socio-economic development and human healthcare**
  - **Meet the demand of electricity and contribute to the energy security assurance**
  - **Contribute to enhance the sccience & technology potential and the potential of national industry**
  - **Contribute to environmental protection**

Strategy for application of Atomic energy up to 2020 (Cont)

Outlook of the development of atomic energy application

1. For Peaceful purposes and socio-economic development

2. Ensure absolute safety for human, environment on the base of international cooperation promotion to take advantage of knowledge, technology and investment.

3. Coordination between ministries and branches along with the mobilization of social power is prerequisite condition in the success of the Strategy.

Strategy for application of Atomic energy up to 2020 (Cont)

General Objective

Step by step build and develop the nuclear industry in order to effectively contribute to the socio-economic development and promote the national science & technology potential.

Detailed objective

- **To apply widely, safely and effectively the radiation energy in economic technique fields. Gradually master some modern technology of radiation energy.**
- **To build and put the 1st NPP into safe operation and effective exploitation. Build up the infrastructure for the long-term development of nuclear power.**
- **To assure the safety, security for radiation and nuclear facilities and public support in nuclear power development.**
- **To build the infrastructure for nuclear R&D in which the Vietnam Atomic Energy Institute will be the high-tech R&D center for atomic energy application in line with regional advanced countries.**

Strategy for application of Atomic energy up to 2020 (Cont)

1. Radiation applications

- **In Public healthcare**

  Develop diagnostic and treatment techniques by radiation energy to meet the demand of around 100 million people in 2020. Build the national capability of matainance, repairment and manufacture of some equipments with high demand. Promote the utilization of the sterile technology. Assess public health and nutrion by radioisotope technique.

- **In Industry and other economic-techniqe branch**

  - Use an develop the radation technology for production on the base of traditional technique

  - Build some high-tech centers

  - Push up research and application of atomic energy in materials science, especially nano-material

Strategy for application of Atomic energy up to 2020 (Cont)

- ***In Meteorology- hydrography and Geology & Minerals***: Serve for inspection, assessment and exploration of mineral resources, underground water management, sediment study and prevention of natural disasters…
- ***In Agriculture and Biology***: Promote research on radiation mutation breeding technique, nutrition of plants and poultry. Produce agricultural products. Strengthen using irradiation technology and nuclear analytical technique to assure the food quality, hygiene and safety.
- ***In environmental protection***: Use nuclear analysis techniques to study, assess the environmental pollution. Waste Treatment. Trace bomb, mine by nuclear technique.

Strategy for application of Atomic energy up to 2020 (Cont)

2. Nuclear Power Development

- ***Develop necessary infrastructure for Nuclear Power Development***
  - **Scheme, Plan and Policy of Nuclear Power Development**
  - **Human resources development**
  - **Research & Development and technical assistance of technology, safety, security and environmental protection for nuclear power development**
  - **Enhance the capability of domestic industries**
- ***Implement the 1st NPP project***
  - **Elaborate the investment report and approval**
  - **Build up and organize tender**
  - **Train staff to operate the NPP**
  - **Implement process and procedures according to regulations**
  - **Build, trial and commercial operation**

Strategy for application of Atomic energy up to 2020 (Cont)

3. Science and technology potential development

Infrastructure and technical basis

- Promote the infrastructure and technical basis for the assurance of nuclear and radiation safety.
- Promote the infrastructure and technical basis of radioactive waste management
- Enhance the capability of R&D and technical assistance
- Promote equipments investment and modernization of training means and program

➢ **Human Resources Development:**

The human resources development need anticipating and must have a national program on human resources development

Strategy for application of Atomic energy up to 2020 (Cont)

4. Implementation Solutions

- Improve the system of organization and managment
- Elaborate and perfect the legal system and policy mechanism
- Develop the human resources
- Build up and implement the national target program
- Implement measures of assurance of safety, security for radiation and nuclear facilities and public suport for the nuclear power development
- Push up the international cooperation and integration
- Investment, Finance and capital mobilization
- Assign tasks between ministries and branches

Organization of strategy implementation

1. *The Master Plan on the Development of Atomic Energy Application for Peaceful Purposes was promulgated on June 24th 2010.*
2. *Plan Orientation on Nuclear Power Plant up to 2030 was promulgated on June 17th 2010*
3. *Planning of Radiation Applications in Healthcare was promulgated on November 4th 2011*
4. *Planning of Radiation Applications in Agriculture was promulgated on June 2nd 2010*
5. *Planning of Radiation Applications in Industrial Sectors was promulgated on January 20th 2011*
6. *Planning of Radiation Applications in the Fields of Natural Resources and Environmental Protection was promulgated on June 10th 2011*
7. *Program on human resources training and development in the field of atomic energy was issued on August 18th 2010*
8. *Scheme on Strengthening the capability of R&D and technical assistance for the development of atomic energy applications and the safety & security assurance has been considered for approval by 2011.*

conclusion

- **It is the first time in the history that the field of atomic energy in Viet Nam has ever had favorable conditions and opportunies for development.**
- **The Atomic Energy Law has been promulgated by the National Assembly and come into effect since January 1st 2009 creating the legal base for the atomic energy construction and development.**
- **The Strategy of Atomic Energy Application for Peaceful Purposes, Master Plan of the Development of atomic energy and detaild plans on atomic energy applications in socio-economic fields have determined decisive directions in R&D and application of atomic energy and assurance of safety and security in this field in Viet Nam.**

Conclusion (cont)

- From research in laboratories, the nuclear power development has been moved to the stage of investment and had considerable concern of high level leaders. On November 25th 2011, the National Assembly has approved the investment and construction of Ninh Thuan 1 NPP. The 1st and 2nd Ninh Thuan NPPs Projects have been being implemented.
- However, Viet Nam still face many difficulties and challenges in the improvement of legal framework, human resources training and development, building up the potential of science & technology and industry and the capability of managment and monitoring.

Conclusion (cont)

- **Therefore, to sucessfully implement the Strategy for Atomic Energy Application, the Master Plan and Detailed Plans on the development of atomic energy applications for socio-economic development and make contribution to build up the national atomic energy, all levels, branches, especially the science & technology staff and management officials need make great effort.**

Thank you for your attention!