Report to the 47TH Regular Session of the IAEA General Conference from the 6TH Scientific Forum

Mr. President

1. The 6th Scientific Forum, organized during the 47th regular session of the IAEA General Conference, took place in the Austria Center Vienna on 16–17 September 2003 under the general title of "New Horizons: Nuclear Energy in a Changing World". The four sessions focused on: Innovative Approaches: Nuclear Power, Innovative Approaches: Nuclear Medicine and Self-reliant Institutions, IAEA Safety Standards: Towards Global Application, and Safeguards Technology: Challenges and Limitations. Each of the sessions consisted of an introduction by a moderator knowledgeable in the specific field and presentations by leading experts followed by panellists' comments and discussion with participants.

2. In Session 1, it was noted that world demand for energy is growing at a rate of 2.3% per year and will increase by 43% by 2025. Although no large increase in the use of nuclear energy is foreseen in the near and medium term, in the longer term an increased use of nuclear energy is generally predicted as a solution to meet the needs of global sustainable development, especially if significant reductions in carbon dioxide emissions are required.

3. The outcome of the International Conference on Innovative Technologies for Nuclear Fuel Cycles and Nuclear Power held in June in Vienna recognized a lack of understanding between the nuclear community and the public. Communication has to be substantially improved both within the nuclear community and with the public. Nuclear energy has a major role to play, and a major long-term shift in the market for nuclear energy towards today's developing countries was anticipated. Although the current nuclear industry has reached the level of maturity, innovation would be required for further improvement of safety, economy, sustainability, and proliferation resistance even for the near term deployment of nuclear technology. It is necessary that nuclear power generation should be within the acceptable range of costs. For the developing countries to harness the potential of nuclear power appropriate solutions need to be found such as establishment of a special international fund etc. Nuclear system modelling may help for drawing conclusions about the future direction of research and development and there was general agreement that extensive international co-operation

is necessary. The need to have synergy between various international initiatives particularly between INPRO and Generation IV was stressed.

4. INPRO project was started by IAEA by asking whether nuclear energy could be a key, substantial part of meeting the energy needs for sustainable development particularly for developing countries. INPRO studied the new scenarios of the Intergovernmental Panel on Climate Change (IPCC), particularly their conclusions about nuclear power and nuclear generated hydrogen, and the answer is that nuclear energy does have a major role to play, and the scenarios anticipate a major long-term shift in the market for nuclear energy toward today's developing countries.

5. An outline of the Generation IV International Forum (GIF) programme was presented. The GIF member countries prepared a Generation IV technology roadmap, which identified the six most promising reactor systems and fuel cycle concepts and the R&D necessary to improve these concepts for commercialization by 2030. Furthermore, the Advanced Fuel Cycle Initiative was initiated to reduce the volume of spent nuclear fuel and thereby reduce the cost of geological disposal, reclaim valuable energy in spent fuel and reduce inventories of civilian plutonium, and reduce radiotoxicity of spent fuel.

6. The report of the interdisciplinary group from the Massachusetts Institute of Technology, USA on the future of nuclear power was presented. The economics, safety, waste management and non-proliferation challenges of enabling a global mid-century deployment of about 1000 GW(e) were addressed through a set of findings and policy recommendations, including that such a mid-century growth scenario should be based primarily on thermal reactors operated in a once through mode. It suggests that a major international effort should be launched to develop the analytical tools and to collect essential scientific and engineering data for integrated assessment of fuel cycles.

7. Early opportunities may exist for demonstration and implementation of nuclear-generated hydrogen. The refining industry could see the first large-scale use of nuclear energy for hydrogen production — an initial but critical step to the 'hydrogen economy'. The increased demand for hydrogen is the result of using heavier crude oils in the manufacture of gasoline and other petroleum products. If the price of natural gas,

the main feedstock for hydrogen production, remains at current levels or rises, alternative approaches to hydrogen production will become attractive.

8. On the topic of nuclear power from fusion the advantages identified are inexhaustible fuel resources, ecological benefits, improved safety, a significantly lower level of radioactive waste, and an absence of materials that could be used for weapons. An engineering design for a 500 MW thermal reactor was completed in 2001. The negotiations concerning ITER construction have been started. Canada, Japan, France and Spain proposed options for site selection.

9. There was general consensus that consideration should be given to the feasibility of multilateral co-operation on key aspects of the nuclear fuel cycle, particularly in view of the increasing non-proliferation, safety, security and technical challenges facing nuclear power. This consideration could include the merits of adopting a multilateral approach to the use of weapon-usable material in civilian nuclear programmes such as processing and production of such material in international centres with appropriate rules of transparency, control and assurance of supply.

10. There was a broad agreement among the participants that international collaboration in general should be improved and substantially expanded. The IAEA is expected to play a key role in co-ordinating international efforts to develop innovative technologies.

11. Session 2 on innovative approaches on nuclear medicine was introduced by referring to the advantages that tele-nuclear medicine techniques could bring to nuclear medicine. Reference was made in particular to the need to get public acceptance of nuclear medicine and for a better understanding of the risks. The advantages were clearly seen in areas of distance learning and uniform reporting between centres, providing a measure of quality assurance in nuclear medicine techniques.

12. Development of internet-based study materials in Thailand for teaching and training in nuclear medicine was undertaken in the frame of an IAEA co-ordinated research project. The aim of the project was to create an information resource and database of nuclear medicine case studies, facilitating self-study by participating nuclear medicine practitioners. The major problems in developing countries for developing regional tele-

nuclear medicine software are a lack of equipment, human resources and gamma cameras. To overcome these problems it is necessary to digitize analogue gamma cameras so that they can be used for and benefit from tele-nuclear medicine.

13. Examples of the use of tele-nuclear medicine in Namibia and Latin America were presented. Patient data needs to be kept separate from scan data and virtual private networks are one solution for confidentiality of data transmission. The issue of fees for service was mentioned along with legal liability and the broader issue of acceptance of nuclear medicine.

14. A demonstration of tele-nuclear medicine software was given and the Forum debated the levels of skills needed to implement and sustain a tele-nuclear medicine network. The Agency's project experience showed that the regional server system needed the services of an informatics specialist, but in local hospitals generally a physicist could be trained in the technology. As regards data collection, it was recommended that dedicated boards be created to oversee and select website material.

15. The session participants concluded that the Agency has a central role to play in promoting and implementing tele-nuclear medicine.

16. The second part of Session 2 dealt with the development of greater self-reliance within nuclear institutions. An important topic was the concept of increasing self-reliance within nuclear institutions to reduce their financial dependence on state funding and, hence, to ensure their sustainability. Since the middle 1980s and particularly in the 1990s, the pressures experienced by many nuclear institutions to curtail their dependence on funding from government, has shaped the strategies and policies in these organizations.

17. The Nuclear and Energy Research Institute (IPEN), Brazil, is a non-profit organization wholly owned by the National Commission of Nuclear Energy (CNEN). Although it focuses on domestic supply of radioisotopes, a few orders have also been produced for other countries within Latin America. CNEN also has the sole responsibility in Brazil to regulate the import of radiopharmaceuticals for nuclear medicine and this ensures a high level of oversight of both imported and nationally produced radioisotopes.

18. A wider scope of activities directed towards increasing self-reliance has been introduced at the Malaysian Institute for Nuclear Technology Research (MINT). MINT's three long-term strategies are: first, the relevance of the national nuclear institution in the context of mainstream socio-economic development; second, the need for the nuclear institution to fulfil social obligations; third, improving the image and acceptance of nuclear technology by the general public. As in the case of Brazil, the current scope of self-reliance activities is founded on extensive experience and development gained with the IAEA since the inception of MINT in 1972.

19. The Ghana Atomic Energy Commission (GAEC) has carried out a critical evaluation of its R&D activities, defined its core competencies, restructured its two institutes and five centres, and established strategic business and marketing plans. Progress towards establishing commercial income-generating units has led to self-funding levels of between 20% and 40% of annual operating expenses within the various commercialising centres. The very rapid progress achieved by GAEC in its commercialisation programme shows the benefits of the co-operation with other centres within the region that have had more experience with their own commercialisation programmes, which has been carried through the IAEA's regional AFRA programme.

20. The third session was devoted to the IAEA Safety Standards and their global application. Since the early days of the IAEA, the promulgation of standards, covering the areas of radiation and transport safety, the safe management of radioactive waste and the safety of nuclear installations, has been one of the statutory functions of the organization.

21. The safety standards on radiation and transport have been instrumental in bringing about excellent safety records in these areas. Although the first set of standards on radioactive waste and nuclear safety acquired the poor reputation of being developed according to the lowest common denominator, the situation now is entirely different in this regard: all IAEA standards are now being developed and revised with the goal of enhancing safety in all Member States. A general agreement has emerged that all IAEA safety standards reflect a high level of safety and should serve as the global reference for the protection of people and the environment. Many regulatory bodies already use the IAEA standards as reference, but global implementation is still a challenge.

22. Keynote speakers characterized the process of the development and review of the standards as a consensus-building process with heavy involvement of experts and stakeholders from Member States. This consensus should pave the way for their ultimate acceptability and application by all users. The discussion underlined the need for the Agency and its Member States to seek more opportunities for involving stakeholders in the various stages of the process. An example that was discussed is the IAEA transport regulations, covering an area that by its very nature is international, which are developed in close consultation with the national regulators and parties subject to the regulations. As a result, the regulations are widely applied in maritime, air, road and rail transport and incorporated by the international organizations like the International Maritime Organization and the International Civil Aviation Organization in their rules and assimilated in national regulations and practices.

23. Co-sponsoring of safety standards, by involving other international organizations, is seen as another mechanism to promote worldwide acceptance. The example of the International Labour Organization shows the inclusion of organizations of employers and workers as major stakeholders.

24. In the radiation protection area one of the keynote speakers illustrated the incorporation of relevant IAEA safety standards in a national system of legislation and regulatory requirements and guides, an example of a State where the Agency's Model project on Upgrading Radiation Protection Infrastructure has been very successful. Over 80 countries are currently receiving assistance in developing relevant national rules and regulations.

25. A proposal was presented for a regional approach in Europe for adopting the IAEA safety standards in the areas of nuclear installation safety and waste management. There was considerable debate on the added value and actual implementation of European standards. Regardless the outcome of the debate on European standards, there is a clear consensus that the IAEA safety standards will serve as their basis. Alternative mechanisms were suggested, such as using the national reporting and peer review under the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, in order to establish to what extent States have adequate national rules and regulations in place.

26. International standards organizations develop industrial standards that complement the IAEA safety standards by specifying detailed requirements for design and operation of components and procedures. It would be desirable for these types of standards, developed by the International Organization for Standardization and the International Electrotechnical Commission, to use a common structure and share the glossaries of terms together with the IAEA safety standards.

27. Professional societies, especially those in the medical area, are considered as stakeholders that could play an important role in the development and review of IAEA safety standards. They could subsequently assist in the dissemination of these standards amongst a wide audience of potential users of nuclear technology, channel feedback on the use of the standards, and contribute to updating and the continuous improvement of the standards.

28. The fourth session highlighted the technological challenges posed by the implementation of measures for strengthening safeguards, including the Secretariat's efforts to keep abreast of technological development and to implement new technology to optimize the effectiveness and cost-efficiency of safeguards implementation. It also focused on some of the limitations of the Agency's current safeguards technology in terms of both capability and resources.

29. The four presentations given in the Session covered two broad aspects of safeguards technology: information handling and analysis and in-field verification activities. Particular emphasis was given to the use of technology for the safeguards State evaluation process, specifically the collection and analysis of open source information including satellite imagery; the use of environmental sampling techniques, and future safeguards equipment needs and technology. Speakers and panellists highlighted some salient points associated with the development of safeguards technology against the backdrop of the strengthened safeguards system, for example: a large volume of information, equipment and safeguards samples; the built-in obsolescence of much new equipment; the long lead-time for new technology; unique boundary conditions and limited financial resources.

30. On the first point, the introduction of safeguards strengthening measures means that the Agency needs to handle a more extensive volume of information, equipment and safeguards samples than ever before. This requires specific underpinning infrastructure such as new databases and other tools; new skills and training, which must be dynamic to respond to changing requirements. Safeguards development is continually aiming at a moving target.

31. The issue of obsolescence derives from a rapidly changing technological environment. There is built-in obsolescence in such areas as information technology systems and in-field equipment. The Agency needs to cope with all of that and is attempting to do so. In that regard, the Session noted, inter alia, that a major project is underway to modernize the safeguards information system and that an equipment-upgrading programme is in place.

32. The Session also noted that the Department of Safeguards must try to envisage future equipment and technology needs early on, in view of the long lead-time required for development.

33. New measures for strengthening safeguards mean recourse to new techniques and methodologies. The Agency needs to continue to keep abreast of state-of-the art technology and to incorporate it properly in its development programme. One constraint it faces is its heavy dependence on the capability of others, due to the fact that it does not, in itself, have all of the necessary technical capabilities. This is essentially a resource problem.

34. The development of safeguards technology is carried out under unique boundary conditions. The market for dedicated equipment for safeguards use is small and manufacturers cannot easily recover the huge development costs involved. Hence, the development of safeguards equipment is frequently an unattractive option commercially. Other examples of unique boundary conditions are that:

    - in-field equipment must operate in harsh environments with sufficient reliability;

- Instrumentation must be non-intrusive and acceptable to State authorities and facility operators;

- Data authentication and tamper-proof measures needs to be incorporated; and

- The confidentiality of information needs to be protected.

35. Because of the zero real-growth Agency budgets that have characterized the last decade, the Secretariat does not have sufficient resources to enable it to address its many challenges in full. In this context, the Member State Support Programmes for Agency Safeguards (MSSP) have been major contributors to the personnel, financial and technical resources required.

36. During discussion on how to cope with the kinds of challenges and limitations recommendations made were:

- Given that it is neither technically nor financially possible for the Agency to be self-sufficient technologically, it should try to identify specific areas in which support from States would be useful and beneficial. An example of this is the establishment of the Network of Analytical Laboratories. Other possible areas of co-operation should also be investigated;

- Member States should continue to support the Department of Safeguards in keeping up to date with appropriate technology. In particular, on-going MSSP support is essential to equipment development;

- The Department of Safeguards should make greater use of the capabilities of State Systems for the Accounting and Control of Nuclear Material (SSAC). More use of SSAC effectiveness leads to greater efficiency in safeguards implementation;

- A key priority is the further development and refinement of integrated safeguards. This should be aimed not only at increasing safeguards effectiveness but also efficiency.

37. Thus, the 6th Scientific Forum addressed a number of key issues for the nuclear community. Proposals have been made for several actions by the Agency and these are commended to you.