



“Safe and Peaceful Use of Nuclear Energy - an IAEA Perspective”

*Address by Mohamed ElBaradei
Director General
International Atomic Energy Agency*

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From its very beginnings, the development of nuclear energy has drawn two reactions: hope, that its safe and peaceful use will bring a better future throughout the world; and apprehension, that its abuse or misuse would have the opposite effect. As we approach the new millennium, in many senses the future of nuclear energy is at a cross-roads: there are new hopes and opportunities but there remain apprehensions and major challenges.

It is my intention this evening to present an overview of the main issues facing nuclear energy. I will deal with three major areas: the contribution of nuclear energy to economic and social developments, nuclear safety and verification. I will conclude with some comments about the future but I should first clarify the role of the International Atomic Energy Agency (IAEA).

The IAEA

The IAEA was created 41 years ago with a mandate to co-ordinate international co-operation for the regulation and use of a technology that cuts across many sectors. Its twin objectives were to seek to enlarge the contribution of atomic energy to peace and development and to ensure, so far as it is able, that atomic energy is used within a sound framework, i.e. peacefully and safely.

Enlarging the contribution of atomic energy to peace and development has been translated for the IAEA into a threefold task: to act as a catalyst for the scientific community and as a hub for state-of-the-art technology; to conduct comparative assessments on the risks and benefits of nuclear and other technologies, thereby enabling States to make informed and appropriate

choices; and to act as a centre for the transfer of nuclear technologies so as to ensure their accessibility to Member States in general, and to developing countries in particular. The objective of ensuring the use of nuclear energy within a sound framework has been a twofold task for the Agency: to assure, through its verification system, that pledges to use nuclear energy exclusively for peaceful purposes are fulfilled and, equally, to strive for the highest level of safety in all areas of nuclear energy's use.

This twin role of the IAEA is often misunderstood as seemingly contradictory because it simultaneously involves the promotion and regulation of nuclear energy. The Agency was however never intended to promote nuclear energy in any commercial sense or to be a partisan organization. Its role was to be an objective and scientifically credible institution that serves as a centre for objective analysis, expert advice, standard setting and credible oversight and verification. And it is from this vantage point that I would like to address you tonight.

The Contribution of Nuclear Energy

Nuclear energy currently accounts for some 17 percent of world electricity supply. Recent studies foresee an increase in electricity demand world-wide by a factor of two to three by the year 2030 and in Asia by a factor of seven and more. These demands are mostly driven by growing economies in the developing world. The projection is that the fast-growing demand for energy will require the use of all available energy sources on the one hand, and a switch to a more environmentally friendly mix on the other. That mix certainly will vary from one country to the next and will be driven by economic, environmental and geopolitical factors.

Two decades ago, nuclear energy was hailed as the energy of the future. Today, it is stagnant in the United States and Western Europe but it is expanding in East Asia, South Asia and Eastern Europe. Global environment considerations such as those discussed at the Kyoto Conference on achieving global reduction in greenhouse gas emissions should encourage a fresh look at nuclear energy's potential contribution to combat the greenhouse effect. It is already a mature and readily available technology for cost-effective mitigation of greenhouse gases over the long term and present accounts for the avoidance of about eight percent of global carbon emissions.

Nuclear power alone cannot ensure secure and sustainable energy supply world-wide, nor can it be considered as the only means of reducing greenhouse gas emissions. But together with renewable sources, improved fossil fuel conversion, and efficiency improvements throughout the energy system, nuclear power could continue to play a key role in national energy strategies. The contribution of nuclear power to the global energy mix will however be influenced to a great extent by the degree of public trust in the safety of both its operation and of waste disposal and in the regime to guard against its diversion to non-peaceful ends. The contribution of nuclear power will also be influenced by economics. In an increasingly competitive and deregulated energy market the industry will have to demonstrate the cost-effectiveness of nuclear power. It has the challenging task of developing advanced reactors of small and medium size with drastically reduced construction times and lower capital costs. Several such concepts are under development.

In non-energy sectors, nuclear applications are making a valuable and expanding contribution to human health and sustainable development. Nuclear techniques have contributed to the early diagnosis and treatment of cancer, the assessment of nutritional deficiencies in women and children, the timely detection of communicable diseases, and the accurate measurement of radiation doses to patients. Nuclear techniques have been instrumental in the eradication of pests such as tsetse flies and fruit flies in parts of Africa and Latin America. They are being used successfully in animal health improvement, in agriculture to increase crop yields and in hydrology to improve the efficiency of water use. Nuclear techniques are also making a substantial contribution to the utilization of other energy sources, including the evaluation of geothermal energy resources and the development of pollution abatement technology in coal-burning plants.

Safety

I turn now to the subject of safety. Safety, to my mind, presents some of the greatest challenges to the future of nuclear power. Public acceptance depends critically on a demonstrated, consistent record of safety in all nuclear applications, including in the safe disposal of radioactive wastes.

Safety is the responsibility of national governments. The IAEA plays a fundamental role, but except in relation to our own Agency operations, we have no power to enforce - only to

recommend, advise and assist. Our approach has been to seek to establish a global nuclear safety culture comprising: legally binding international agreements, non-binding safety standards and the provision of safety services.

Since Chernobyl, national governments have responded positively to the need for a comprehensive nuclear safety regime. A number of important new international conventions have been agreed, four of them in the past two years. They deal with early notification of a nuclear accident; assistance in the case of a nuclear accident or radiological emergency; nuclear safety with respect to land-based nuclear power plants; the safety of spent fuel and radioactive waste management; and revisions to the regime for international liability. The broad purpose of these legal instruments is to establish harmonized minimum safety standards in all countries and to ensure adequate compensation in the event of a nuclear accident.

These achievements need consolidation. The priority now is for States which have not yet done so to complete their internal processes and adhere to these conventions. But we also need to be proactive in identifying areas still in need of binding norms. No interests are served if it requires a major accident before the international community is prepared to take prudent precautionary measures. Research reactors, fuel cycle facilities, illicit use of nuclear and other radioactive materials, transport of nuclear material and radiation protection are areas which the IAEA Secretariat is examining with a view to reporting to our Member States on whether they would benefit from binding standards.

It is equally important to ensure not only that binding norms and standards are adopted but that they are also implemented. A key element in the improvement of safety culture is the extensive range of practical assistance services provided by the Agency for on-site peer review and expert advice. These services are for the benefit of all. They should be used more extensively. The IAEA Nuclear Safety Review for 1997, which is about to be released, shows an overall positive trend. However, it also identifies some areas of deficiency in the management of operational safety, even in countries with long established nuclear programmes. The underlying causes seem to be linked to the absence of key elements of safety culture. Different reasons have been postulated: complacency bred by a hitherto safe record, cost cutting in a competitive energy market, authoritarian management practices, among others, but whatever the reasons there is significant room for improvement.

In addition to standard setting and expert advisory services, the Agency has been assisting Member States in the application of advanced science, technology and modern engineering to improve the performance and safety of nuclear power development, nuclear fuel cycle and radioactive waste management. Such activities have included supporting technology development and transfer, quality assurance, design and engineering for operational safety, training and qualification of plant management and plant personnel and strengthening of technical support infrastructure in Member States. While most of these activities have a technical objective, their cumulative effect contributes to improving safety and reliability of operating nuclear facilities.

At the IAEA's Board of Governors meeting last month, I canvassed several elements of a renewed safety strategy. First, and already in hand, is the development of National Safety Profiles covering radiation protection, waste safety and the safety of nuclear installations. These Safety Profiles will be particularly helpful for the Agency to have a clear and accurate picture of the needs of Member States to effectively target our activities. Second, it is my intention to raise identified or potential safety problems with relevant Member States. It is not the Agency's job to remedy shortcomings, but it is our duty to draw them to the attention of Member States who themselves have the responsibility to devote appropriate resources, with possible assistance from the Agency. Third, is the need to be more active in promoting our safety services in all countries. The purpose of these services is not to criticize - their purpose is to assist Member States in reviewing the safety status in the country, identifying strengths and weaknesses and remedying those weaknesses. A fourth element is for the Agency to describe events that have a wider significance for nuclear safety, to look ahead at likely prominent issues, report on safety measures that need to be taken and indicate the magnitude of resources needed. The fifth element is the strengthening of the Agency's interaction with the nuclear safety community - regulators and operators - governmental and non-governmental.

As you can see from the foregoing, there have been substantial improvements in the area of safety, but governments and operators should be aware that more needs to be done. The issue of waste management is particularly important. Waste from nuclear techniques in medicine, agriculture and industry presently accounts for the largest volume of total radioactive waste generation. The forthcoming decommissioning of a number of power and research reactors will add substantial quantities of both high and low level waste to this volume. I believe we

have come to the time when action is required. The nuclear community must not only say that radioactive wastes can be safely disposed, it must also demonstrate this by building final repositories.

Peaceful Use

Let me now turn to the subject of verification of the exclusively peaceful uses of nuclear power. It is clear to my mind that realization of the opportunities for arms control and reduction provided by the end of the cold war depends critically on effective systems of verification and safeguards.

In 1997 the Agency was applying safeguards in almost 70 countries at over 900 facilities - and involving more than 10,000 days of inspection. In the DPRK, since 1994 we have maintained a continuous presence of inspectors for the purpose of monitoring the "freeze" on the DPRK graphite moderated reactors and related facilities. The situation has remained stable and we have been able to verify that the programme remains frozen. However, in nine rounds of technical discussions, there has been no progress on the long-standing and important issue of the preservation of information which must remain available to enable the Agency to verify, in the future, the history of the DPRK's nuclear programme and its full compliance with its Safeguards Agreement.

In the case of Iraq, the Agency was mandated under Security Council resolution 687 (1991) to carry out on-site inspection of Iraq's clandestine nuclear weapons programme and destroy, remove or render harmless the components of that programme. Most of the IAEA's activities involving Iraq's clandestine nuclear weapons programme were completed by the end of 1992. Since that time, only a relatively small number of items of proscribed equipment and materials have been identified and disposed of. While no indications of the presence of further proscribed equipment or materials in Iraq have been found, the IAEA cannot provide absolute assurance of the absence of readily concealable items, such as components of centrifuge machines or copies of weapons-related documentation.

The IAEA's activities regarding the investigation of Iraq's clandestine nuclear programme have reached a point of diminishing returns and the Agency is focusing most of its resources on the implementation and technical strengthening of its plan for the ongoing monitoring and

verification (OMV) of Iraq's compliance with its obligations under the Security Council resolutions. The IAEA is not however "closing the file: on its investigation of Iraq's clandestine nuclear programme and will continue to exercise its right to investigate any aspect of that programme, that warrants further investigation.

The Strengthened Safeguards System

For much of its existence, the full potential of the IAEA as the global instrument for nuclear verification was restricted to a safeguards system that focused primarily on nuclear activities declared by the State. The system failure in Iraq, the situation in the Democratic People's Republic of Korea (DPRK), and the experience gained from South Africa's decision to abandon its nuclear weapon programme and join the Non-Proliferation Treaty (NPT), made it clear that any effective verification system must cover not only declared activities but also possible undeclared activities.

Over the past six years the Agency has been at the forefront of new international efforts to raise the level of assurance through a qualitatively strengthened safeguards system. Some measures were introduced within existing IAEA authority but the key elements of the new system required additional legal authority. In May last year, the IAEA Board of Governors approved the Model Additional Protocol which culminates what became known as the Programme 93+2 process to develop a strengthened safeguards system. On the basis of this model, individual States are invited to conclude a Protocol additional to their existing safeguards agreement.

To fully understand the new strengthened safeguards system it is important to be aware of the limiting features of the current system that is based on nuclear material accountancy. Information provided under this system is limited to nuclear material. Access to the nuclear facilities is fairly circumscribed. And the system did not normally concern itself with the completeness of the information provided but only its correctness, i.e. whether the nuclear material reported by the State is accounted for but not whether the State has nuclear material that it did not declare.

The strengthened safeguards system by contrast is based on different principles. First, the system must be effective in dealing with both declared and possible undeclared activities. It

must provide as complete a picture as possible of the state of nuclear activities and not limit itself to the confines of nuclear material. And it must allow the Agency an adequate right of access. The system must also be cost efficient - both to governments and to nuclear operators. Effectiveness and cost efficiency: I will deal with each of these in turn.

Effectiveness has three components: more information, more access and greater use of appropriate technology. The new system provides for a qualitative and quantitative improvement in information. Through an Expanded Declaration, in addition to information on nuclear material, States are required to provide detailed information on all other nuclear and nuclear-related activities from uranium mines to closed-down facilities and those under construction as well as information on all export and import of nuclear related items.

Greater information requires improved information analysis. The Agency has substantially strengthened its analytic capacities including through a computerized system for storage and retrieval of information and through the development of a computer model for the analysis of all known processes for the production of weapons-usable material. The bottom line with respect to information is that the Agency now has a better vantage point from which to develop a comprehensive picture of all nuclear activities in a State and to detect any inconsistency or anomaly in that picture.

Inspector access has been a key issue since the beginning of safeguards. Whereas previously, access was generally limited to specific "strategic points", under the strengthened system a State is required to provide access to any place on a nuclear site and to other locations where nuclear material is present. The State is also required to provide access to all locations that are, or could be, engaged in nuclear fuel cycle related activities and, if this is not possible, to make every reasonable effort to satisfy Agency requirements without delay through other means. The need in certain circumstances to establish a balance between the Agency's need for access and the State's need to protect certain technological and other sensitive information is catered for in the new system through a procedure for "managed access". Of particular importance also are the new modalities for access including greater use of unannounced inspections. Delay or obstruction of safeguards inspections through administrative impediments will not be accepted.

The third aspect of effectiveness concerns the better use of technology. The Agency has the right to collect environmental samples anywhere it has a right of access. Results to date have demonstrated that these techniques are powerful tools for detecting undeclared activities and that sampling provides information about the full range of past and current nuclear activities at the specific site. The Agency is also preparing for extensive use of remote monitoring technology transmitting to IAEA headquarters in near-real time images and results appropriately authenticated and encrypted.

As you will appreciate, these new measures have involved a substantial resource investment in training of inspectors, research and development of new technology, improved information gathering and analysis capacity and better communications. However, the commitment of the new system is to overall cost neutrality.

One area of likely savings will come after the introduction of the new technology. Remote monitoring and environmental sampling auger well for possible reduction in the need for on-site inspection. Second, there are possible savings from meshing the old and the new measures and not simply adding them together. For example, it may be possible to provide sufficient assurance with regard to a lack of undeclared processing to be able to forego some traditional measures such as interim inspection on spent fuel. Third, we are seeking increased and improved co-operative arrangements with national and regional systems. The new partnership approach with Euratom is a useful model which establishes a prudent division of labour while respecting the individual mandate of each organization and its responsibility to maintain its own independent conclusions. Fourth, are savings arising from acceptance by all of the new efficiency measures contained in the Additional Protocol. These include multiple entry visas, simplified designation of inspectors and facilitation of communication with the Agency.

The priority now is to sustain and build on the present momentum towards the conclusion of Additional Protocols. Eight States have now signed, and there has been encouraging progress in recent consultations with new countries, including members of the European Union, Japan, Canada, as well as the United States. I am happy to report that agreement has been reached on the new Protocols with members of the European Union, Euratom and the IAEA which will be submitted to the IAEA Board of Governors for approval in June. In my view, the conclusion of all Additional Protocols by the end of the year 2000 is not an unrealistic goal.

The more finely meshed system being introduced can raise substantially the value of the verification assurance. And States which subscribe to the Additional Protocol should be able to receive additional assurances about the peaceful nature of their nuclear activities. However, it must be recognized that even with full implementation, the new safeguards system in and by itself cannot provide 100 percent assurance. The nature of the verification assurance is a “negative” assurance based on the propositions that we have not observed any diversion and that in the absence of any such observation we have no reason to reject the claim by the relevant State that no diversion has taken place. Some uncertainty is inevitable in any country-wide verification system that aims to prove the negative, i.e. prove the absence of concealable objects or activities. The extent to which such uncertainty is acceptable is a policy judgement. As I mentioned before, a degree of uncertainty exists even in Iraq, despite the extensive rights granted to the IAEA by the Security Council. It should however be borne in mind that the assurance derived from Agency safeguards is to be supplemented and reinforced by other parts of the non-proliferation regime, including export/import control, the Security Council, as well as regional and global security arrangements. There are clearly still gaps and shortcomings in some parts of the non-proliferation regime which we need to continue working to close.

The Future

The end of the cold war has brought profound changes. For the first time, the international community can justifiably place hope equally on non-proliferation and on the prospects for nuclear disarmament. Effective verification is the key to turning these prospects into reality. In this respect, the new strengthened safeguards system is a watershed in increasing the level of non-proliferation assurance. The new system is technically a major leap forward. But equally, if not more important, is the political commitment that has been demonstrated. In supporting an “intelligent” verification system - one where qualitative assessment is now taking its place alongside number crunching - the international community has demonstrated a high degree of confidence in multilateral verification mechanisms. This is of particular importance as we move forward towards nuclear arms control.

Most recently, under the Trilateral Initiative between Russia, the United States and the IAEA, the Agency has been given the role to verify that fissile materials removed from weapons and defence programmes are not again turned to weapons use. To date 12 tonnes of excess highly

enriched uranium (HEU) and plutonium have been placed under IAEA inspection under the Voluntary Offer Safeguards Agreement with the US. In addition, the US committed itself to putting 52 tons of fissile material at the disposal of the Agency. President Yeltsin has stated that some 40 percent of Russia's stock of weapons grade plutonium will be stored under IAEA safeguards in the Mayak facility which is presently under construction. Technical meetings with the parties are continuing as the Agency seeks to find answers to new and complex verification questions, such as what techniques can be used to enable the Agency inspectors to verify weapons material without learning about weapons design and other proliferation-sensitive information. It would be prudent as we move towards nuclear arms control to start investing now in the research and development required for new verification concepts and techniques.

Developments in the area of safety of nuclear applications are also making progress. Over the past five years we have been largely "catching-up" and we still have a way to go to ensure that every State conducting nuclear activities has a sound regulatory infrastructure, that every nuclear operator is implementing "best-practice" safety culture, that all present safety standards have been updated and that sufficient political will is demonstrated to agree on binding standards where these are still required and to construct safe and final repositories for radioactive waste.

The fact is that the full potential of nuclear energy - both for electricity generation and non-power applications - is yet to be achieved. For example, an area of growing research and technological development is the possible use of small and medium size reactors for desalination of water and electricity generation in remote and arid areas. Another area where research has begun is the possible use of nuclear techniques in land mine detection. But as I mentioned, whether that full potential will be achieved, depends on how successful we are in addressing concerns about safety, waste disposal and proliferation of nuclear weapons.

People often ask me, as Director General of the IAEA, if I am optimistic about the future of nuclear energy. It is not my job, or that of the Agency, to be optimistic - our role is to be prudent providing objective data, conducting scientific analysis, furnishing expert advice - in other words, enabling Member States to make policy choices in full awareness of all relevant facts. The decision to resort to the nuclear power option is a national decision that takes into account the specific circumstances, needs and requirements of each State. But, the Agency's

role then is to see to it, in the name of the international community and within the mandate given to it, that this national decision is matched by a commitment to use nuclear energy at a high level of safety and exclusively for peaceful purposes. These are tasks worthy of your support.