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REPUBLIC OF KENYA

THE NATIONAL ASSEMBLY

ELEVENTH PARLIAMENT

THIRD SESSION

2015

THE DEPARTMENTAL COMMITTEE ON ENERGY, COMMUNICATION AND INFORMATION

REPORT ON

THE SCIENTIFIC VISIT TO THE INTERNATIONAL ATOMIC ENERGY AGENCY IN VIENNA, AUSTRIA

FROM 3RD -7TH OCTOBER, 2014

Clerk's Chambers,
Parliament of Kenya
Nairobi

APRIL, 2015

1.0 PREFACE

Hon. Speaker,

On behalf of the Members of the Departmental Committee on Energy, Communication and Information, and pursuant to the provisions of Standing Order No. 216, it is my pleasure to present to the House the Committee's Report of the scientific visit to the International Atomic Agency (IAEA) in Vienna Austria from 3rd -7th November 2014 in Vienna Austria.

1.1 Committee Mandate

The Committee is established under *Standing Order 216 and* mandated pursuant to the *Standing Order 216 (5)*

- Investigate, inquire into, and report on all matters relating to the mandate, management, activities, administration, operations and estimates of the assigned ministries and departments;
- Study the programme and policy objectives of ministries and departments and the effectiveness of their implementation;
- Study and review all the legislation referred to it;
- Study, access and analyze the relative success of the ministries and departments measured by the results obtained as compared with their stated objective;
- Investigate and inquire into all matters relating to the assigned ministries and departments as may be deemed necessary, and as may be referred to it by the House or a Cabinet Secretary;
- Vet and report on all appointments where the Constitution or any law requires the National Assembly to approve, except those under Standing Order No.204 (Committee on appointments); and
- Make reports and recommendations to the House as often as possible, including recommendations of proposed legislation.

In accordance with Second Schedule of the Standing Orders, the Committee is mandated to oversee Fossil fuels exploration, Development of energy, Production of energy, Maintenance and regulation of energy,Communication, Information, Broadcasting ,Information Communications Technology (ICT) development and management.

1.2 Committee Membership

The Committee comprises of the following Members:

1. The Hon. Jamleck Kamau, EGH, MP..............................Chairperson
2. The Hon. Jackson Kiptanui, MP ....Vice –Chairperson
3. The Hon. Mohammed Elmi, EGH, MP
4. The Hon. (Eng) James Rege, MP
5. The Hon. (Eng) Nicolas Gumbo, MP
6. The Hon. Mithika Linturi, MP
7. The Hon. Mary N. Mbugua, MP
8. The Hon. Vincent Musau, MP
9. The Hon. Zebedeo Opore, MP
10. The Hon. Aramat Lemanken, MP
11. The Hon. Arthur Papa Odera, MP
12. The Hon. Banticha Abdullahi, MP
13. The Hon. Daniel Kazungu, MP
14. The Hon. Esther Gathogo, MP
15. The Hon. Fathia Mahbub, MP
16. The Hon. James Lomenen, MP
17. The Hon. Aburi Mpuru, MP
18. The Hon. Joe Mutambu, MP
19. The Hon. Junet Sheikh, MP
20. The Hon. Kanini Kega, MP
21. The Hon. Mati Munuve, MP
22. The Hon. Nicholas Ngikor, MP

23. The Hon. Onesmus Njuki, MP
24. The Hon. Rachael Amolo, MP
25. The Hon. Roba Duba, MP
26. The Hon. Ndungu Gethengi, MP
27. The Hon. William Kisang, MP
28. The Hon. Richard Tongi, MP
29. The Hon. Moses Kuria, MP

1.3 The Committee Nominations

The Committee in conjunction with the Ministry of Energy and Petroleum nominated the following Members for the study visit.

1. Hon. Aden Duale, MP –**Leader of Majority/Leader of Delegation**
2. Hon. Thomas Mwadeghu, MP- Minority whip
3. Hon. Wilbur Otichillo, MP

The Members Energy, Communications and information Committee

4. Hon. Zebedeo Opore, MP-
5. Hon. Junet Sheikh, MP

The delegation was accompanied by **Mr. Abdiaziz M. Shobay** as the secretary of the Delegation Secretary

1.4 Recommendations by the Delegation

Based on the above observations, the delegation would like to make the following recommendations:

1. Kenya should strive to build its capacity in nuclear power development through research and development at incremental level.
2. Due to high capital investment in nuclear power establishment and the inherent risks the government should focus on the development of

renewable and clean energy (geothermal, solar, hydro, wind etc.) which is readily available and abundant in the country.

3. The government should develop legislation and regulations on the use and disposal of nuclear energy and wastes respectively.

4. Prior to Government decision to build nuclear power station, it must address issues relating to nuclear wastes disposal, nuclear power station sitting and security implications.

1.5 Acknowledgment

The delegation is grateful to the both Honorable Speaker for authorizing the visit, as well as the office of the Clerk for providing the necessary logistical and technical support. The delegation also wishes to express its appreciation to the Ministry of Foreign affairs and International Trade; the staff of the Kenya Embassy in Austria for all the support given before and during the visit. The delegation is also grateful to International Atomic Energy Agency for hosting the programme.

The Committee also acknowledges the Kenya Nuclear Electricity Board and the Ministry of Energy and Petroleum for working in close partnership with the Committee.

Hon. Speaker,

It is my pleasant duty and privilege, on behalf of the Committee to table this report pursuant to provisions of the National Assembly Standing Order 199.

Signed: ....

THE HON. JAMLECK KAMAU, EGH, MP

CHAIRPERSON, DEPARTMENTAL COMMITTEE ON ENERGY, COMMUNICATION AND INFORMATION

Date: 27/8/15

1.6 Background

A Kenyan delegation set out on a scientific visit to the International Atomic Energy Agency in Vienna, Austria. Kenya is member of the IAEA in accordance with the statute of the agency having been admitted to the membership on 12th July 1965. Kenya actively participates and contributes positively in policy making organs of the agency, that is, the board of governors and general conference. Kenya continues to benefit from the agency's technical assistance and cooperation programme. The Kenya Country cooperation Framework (CPF) for the period of 2011-2016 has seven priority areas namely: Human health (support for radiology for cancer, prevention, diagnosis and management in Nairobi, Kisumu and Eldoret); agricultural production and livestock management; industrial application techniques; energy (introducing nuclear power in Kenya is one of the priority projects); water and irrigation; radiation waste management and human resource development across all sectors.

The main objective of the visit was to learn more about advantages and disadvantages of the development and use of nuclear energy and its possible development in Kenya. The five day visit was mainly devoted to exposing the members of the delegation to technical and safety information regarding nuclear energy through presentations by IAEA experts and a visit to Dukovany nuclear power plant in Czech Republic. The topics covered included but were not limited to nuclear technology, IAEA convention safety regulations, nuclear security and physical protection, challenges of disposing nuclear wastes, nuclear disaster emergency planning, funding and financing of nuclear plant, nuclear plant siting considerations and inherent risks and dangers of nuclear plant to terrorism attach and possible use of enriched uranium and nuclear waste to manufacture nuclear bomb.

The following report gives a summary on mandate and programs of IAEA, Nuclear technology and its application , nuclear power development considerations , nuclear power safety and regulations , nuclear material accountability , nuclear emergency planning , challenges of nuclear waste disposal visit to the nuclear plant and the observations and recommendations of the delegation

2.0 INTRODUCTION

The IAEA is the world's Centre for cooperation in the nuclear field. It was set up as the world's "Atoms for Peace" organization in 1957 within the United Nations family. The Agency works with its Member States and multiple partners worldwide to promote the safe, secure and peaceful use of nuclear technologies.

2.1 Organizational Profile

The IAEA Secretariat is headquartered at the Vienna International Centre in Vienna, Austria. Operational liaison and regional offices are located in Geneva, Switzerland, New York, USA, Toronto, Canada and Tokyo, Japan. The IAEA runs or supports research centers and scientific laboratories in Vienna and Seibersdorf, Austria, Monaco and Trieste, Italy.

The IAEA Secretariat is a team of some 2500 multidisciplinary professional and support staff from more than 100 countries. The Agency is led by the Director General and six Deputy Director Generals who head the major departments.

IAEA programmes and budgets are set through decisions taken by its policy-making bodies: the 35 members of the Board of Governors and the General Conference comprising representatives from all IAEA Member States. Reports on IAEA activities are submitted periodically and, as cases warrant, to the United Nations Security Council and the United Nations General Assembly.

IAEA financial resources include the regular budget and voluntary contributions. The General Conference sets the annual regular budget and addresses extra-budgetary funds as well as voluntary contributions made to the Technical Cooperation Fund. These figures are published in the latest IAEA Annual Report.

2.2 IAEA Mission & Programmes

The IAEA's mission is guided by the interests and needs of Member States, strategic plans and the vision embodied in the IAEA Statute. The IAEA is generally described as having three main missions:

- **Peaceful purposes:** Promoting the peaceful uses of nuclear energy by its member states,
- **Safeguards:** Implementing safeguards to verify that nuclear energy is not used for military purposes, and
- **Nuclear safety:** Promoting high standards for nuclear safety.

2.3 Relationship with the United Nations

As an independent international organization related to the United Nations (UN) system, the IAEA's relationship with the UN is regulated by a special agreement. In terms of its Statute, the IAEA reports annually to the UN General Assembly and, when appropriate, to the UN Security Council regarding States' non-compliance with safeguards obligations, as well as on matters relating to international peace and security.

3.0 NUCLEAR TECHNOLOGY AND ITS APPLICATIONS

Nuclear power, or **nuclear energy**, is the use of exothermic nuclear processes, to generate useful heat and electricity. Nuclear power stations work in pretty much the same way as fossil fuel-burning stations, except that a "chain reaction" inside a nuclear reactor makes the heat instead. The reactor uses Uranium rods as fuel, and the heat is generated by **nuclear fission:** neutrons smash into the nucleus of the uranium atoms, which split roughly in half and release energy in the form of heat. Carbon dioxide gas or water is pumped through the reactor to take the heat away, this then heats water to make steam. The steam drives turbines which drive generators. Modern nuclear power stations use the same type of turbines and generators as conventional power stations.

3.1 Nuclear power organizations

There are multiple organizations which have taken a position on nuclear power – some are proponents, and some are opponents.

3.1.1 Proponents

- Environmentalists for Nuclear Energy (International)
- Nuclear Industry Association (United Kingdom)
- World Nuclear Association, a confederation of companies connected with nuclear power production. (International)
- International Atomic Energy Agency (IAEA)
- Nuclear Energy Institute (United States)
- American Nuclear Society (United States)
- United Kingdom Atomic Energy Authority (United Kingdom)
- EURATOM (Europe)
- European Nuclear Education Network (Europe)
- Atomic Energy of Canada Limited (Canada)

3.1.2 Opponents

- Friends of the Earth International, a network of environmental organizations.[276]
- Greenpeace International, a non-governmental organization[277]
- Nuclear Information and Resource Service (International)
- World Information Service on Energy (International)
- Sortir du nucléaire (France)
- Pembina Institute (Canada)
- Institute for Energy and Environmental Research (United States)
- Sayonara Nuclear Power Plants (Japan)

4.0 NUCLEAR POWER DEVELOPMENT CONSIDERATIONS

4.1 Technology Options for a Country's First Nuclear Power Plant

Several Member States of the Agency are considering introducing nuclear power to their energy mix for the first time. Although various technology options are available to these countries, selecting the most suitable nuclear reactor design requires not only a careful understanding of existing designs but also in-depth knowledge of country-specific needs, conditions and other considerations. To make an informed decision, the key characteristics of a particular nuclear project must be clearly understood and specified from the outset and balanced, comprehensive and up to date information about reactor designs, concepts and fuel cycle options must be made available and evaluated.

4.2 Some considerations when selecting the first nuclear power plant

Some elements are of key importance when narrowing down potential nuclear reactor designs to be selected. These include

- The size and stability of the national electricity grid,
- The seismicity of the selected site,
- The availability of water resources for ultimate cooling and the
- Accessibility to water ways or other appropriate transportation routes for the transportation of large components or modules

Therefore, it is important for prospective NPP owners to examine these elements in some detail in order to clearly establish the boundary conditions in the technology assessment process.

The desired level of technological maturity or innovation in the new NPP design is another decision which has to be made early. Structures, systems and components (SSCs), and design and analysis methods and techniques which involve characteristics, materials, manufacturing processes, working conditions and plant environment conditions that are identical or similar to those that have been operated or applied successfully in existing NPPs, preferably over a span of several years, are referred to as 'proven technology'.

4.3 Lessons learnt

Each country needs to balance the benefits and the challenges associated with the selection of a design of a specific level of technological maturity. Some countries may prefer to use the deployment of a new nuclear power programme as an opportunity to develop national capabilities in several key areas associated with these advanced reactor designs. This is usually done through comprehensive technology transfer arrangements with the supplier, where a newcomer country may initially pursue a 'turnkey approach' (following the lead of the supplier country) but would increasingly take on larger and more significant roles in future nuclear projects. Each country needs to strategically evaluate the technological maturity risk they are willing to assume and weigh it against the potential gains in national capabilities associated with innovation and technology transfer.

The level of completion of a design and its licensability in the new hosting country are also important considerations. Choosing a nuclear reactor designs that is finalized and frozen, particularly one that has undergone licensing review in other countries, can minimize project uncertainties. While some modifications may be needed due to local regulatory requirements or due to the special characteristics of a site, a complete design helps to ensure that the project will be within budget and schedule. On some occasions, striking a balance between the use of a large, inexpensive local labor force applying traditional construction techniques on site and the use of advanced construction techniques that may require the procurement of module fabrication facilities (i.e. a 'modular approach') or sophisticated machinery is also important.

A cost-benefit analysis would enable a country to assess whether the increase in construction time when using traditional construction techniques will be offset by the increase in cost associated with the use of more advanced construction techniques. Performance-specific considerations of a given design, such as operability, maneuverability, inspectability, maintainability, availability factor and reliability, are of course also of paramount importance and careful evaluations of each one of those characteristics should be carried out.

Furthermore, it may be of interest to examine the technology options that are being selected in other countries in the same region, since establishing productive regional partnerships would enable efficiencies in areas such as operating experience, spare parts inventories, enrichment and fuel fabrication services, waste and spent fuel management facilities, etc. Similar efficiencies could be achieved by selecting a widely used reactor design and by participating in the 'owners' group' for that design. It is generally recommended that newcomer countries consider both types of partnerships, in particular with more experienced countries or operators. As an additional benefit, these may increase negotiating strength when dealing with suppliers.

5.0 NUCLEAR SAFETY AND REGULATION

The terms *safeguards* and *security* are generally used to describe programs that promote the common defense and security and protect public health and safety by guarding against theft and sabotage. The licensee security programs and contingency plans deal with threats, thefts, and sabotage relating to special nuclear material, high-level radioactive wastes, nuclear facilities, and other radioactive materials and activities that the NRC regulates.

The IAEA classifies safety as one of its top three priorities. It spends 8.9 percent of its 352 million-euro ($469 million) regular budget in 2011 on making plants secure from accidents. Its resources are used on the other two priorities: technical cooperation and preventing nuclear weapons proliferation.

5.1 Obligations of States under Chapter VII of the UN Charter

1. All States are obliged to prevent and suppress terrorist financing; criminalize funding of terrorism; freeze funds and financial assets of persons involved in terrorist acts; and prohibit making funds available for the benefit of persons committing terrorist acts.

2. All States are further obliged to refrain from any form of support to terrorists; take necessary steps to prevent terrorist acts; deny safe haven to terrorists or financers of terrorism; prevent terrorists from using their territories against other States; bring terrorists and those financing terrorism to justice with appropriate penalties; assist in criminal investigations and proceedings; prevent terrorist movement through border controls and controls of identity papers.
3. All States are called upon to, inter alia, become parties as soon as possible to the relevant international conventions and protocols relating to terrorism.
4. All States shall refrain from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear weapons and their means of delivery. All States shall adopt and enforce appropriate effective laws which prohibit any non-State actor to manufacture, acquire, possess, develop transport, transfer or use nuclear weapons and their means of delivery, in particular for terrorist purposes, as well as ancillary crimes associated therewith.
5. All States shall take and enforce effective measures to establish domestic controls to prevent the proliferation of nuclear weapons and their means of delivery, including by establishing appropriate controls over related materials such as effective measures to account for and secure such items in production, use, storage or transport; appropriate effective physical protection measures; appropriate effective border controls and law enforcement efforts; appropriate effective national export and transshipment controls over such items, and appropriate criminal or civil penalties for violations of such export controls.
6. All States are obliged to promote the universal adoption and full implementation of multilateral treaties to which they are parties, whose aim is to prevent the proliferation of nuclear weapons; to adopt national rules and regulations to ensure compliance with their commitments under the key multilateral non-proliferation treaties; and to renew and fulfill their commitment to multilateral cooperation in particular within the framework of the IAEA.

7. All States are obliged to take cooperative action to prevent illicit trafficking in nuclear weapons, their means of delivery and related materials.

5.2 IAEA and the legal framework

The Agency believes that universal adherence to relevant instruments, harmonization of national legal and regulatory frameworks, and effective application of relevant measures can make a major contribution to a global nuclear security system for combating nuclear terrorism. The IAEA seeks to inform and advise States about the relevant international legal instruments, and encourages adherence to and/or implementation of them.

5.3 The binding IAEA security-related instruments are:

Convention on the Physical Protection of Nuclear Material (CPPNM)

Once in force, the amended Convention on the Physical Protection of Nuclear Material (CPPNM) will make it legally binding for States Parties to protect nuclear material and facilities in peaceful domestic use and storage, as well as in domestic and international transport. It will also provide for expanded cooperation between States regarding rapid measures to locate and recover stolen or smuggled nuclear material, mitigate any radiological consequences of sabotage, and prevent and combat related offences current status

5.4 Code of Conduct and Supplementary Guidance

In the Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) and its Guidance on the Import and Export of Radioactive Sources (Supplementary Guidance), States commit themselves to reinforcing the safety and security of radioactive sources by establishing effective controls, and to protect against, and ensure the timely detection of, the theft, loss or unauthorized use or removal of radioactive sources. The 2006 General Conference urged States to write to the IAEA Director General stating that they fully support and endorse the Agency's efforts to enhance the safety and security of radioactive sources and are working toward following the guidance contained in the Code of Conduct.

5.5 Safeguards Agreements

The requirements for accounting and control of nuclear material and for the establishment of the related systems contained in Safeguards Agreements and their Additional Protocols is a major component in the international nuclear security infrastructure.

5.6 Nuclear Terrorism Convention

The International Convention for the Suppression of Acts of Nuclear Terrorism (Nuclear Terrorism Convention)_was opened for signature on 14 September 2005. It details offences relating to unlawful and intentional possession and use of radioactive material or a radioactive device, and use or damage of nuclear facilities. The Convention entered into force in July 2007.

5.7 UN Security Council resolutions 1540 and 1373

United Nations Security Council resolutions 1373 (2001) and 1540 (2004) address, among other things, the threat of nuclear terrorism and nuclear proliferation and call for national, regional and international cooperation to strengthen the global response to these challenges and threats to international security.

5.8 The non-binding IAEA security-related instruments are:

- Code of Conduct on the Safety and Security of Radioactive Sources (INFCIRC/663)
- Guidance on the Import and Export of Radioactive Sources (INFCIRC/663)

- The Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.4)
- Physical Protection Objectives and Fundamental Principles (GC(45)/INF/14)
- Code of Conduct on the Safety of Research Reactors(GOV/2003/7)
- International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (Safety Series No. 115)
- Regulations for the Safe Transport of Radioactive Material – 2005 Edition (Safety Series No. TS-R-1)
- Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety Requirements (Safety Standards Series (No. GS-R-1)
- Safety Requirements on Preparedness and Response to a Nuclear or Radiological Emergency (Safety Standards Series No. GS-R-2)
- Operations Manual for Incident and Emergency Communication IEComm)
- Joint Radiation Emergency Management Plan of the International Organizations (JPLAN)
- IAEA Response and Assistance Network (RANET).
- TECDOC Series
- Handbook on Nuclear Law

5.9 THE ROLE OF IAEA ON NUCLEAR SAFETY AND REGULATION

There are roles that should be played by both IAEA and the state parties involved with nuclear power. However IAEA bears a great responsibility and it's called upon to:

a) Collect and disseminate to States Parties and Member States information concerning: (i) experts, equipment and materials which could be made available; and (ii) methodologies, techniques and available results of research relating to response to nuclear accidents or radiological emergencies;

b) Assist a State Party or a Member State when requested in any of the following or other appropriate matters: (i) preparing both emergency plans and the appropriate legislation; (ii)developing appropriate training programmes for personnel; (iii) transmitting requests for assistance and relevant information; (iv) developing appropriate radiation monitoring programmes, procedures and standards; and (v) conducting investigations into the feasibility of establishing appropriate radiation monitoring systems;

c) Make available to a State Party or a Member State requesting assistance appropriate resources allocated for the purpose of conducting an initial assessment of the accident or emergency;

d) Offer its good offices to the States Parties and Member States in the event of a nuclear accident or radiological emergency;

e) Establish and maintain liaison with relevant international organizations for the purposes of obtaining and exchanging relevant information and data, and make a list of such organizations available to States Parties, Member States and the afore-mentioned organizations

States Parties shall make every effort to adopt appropriate measures to ensure the protection of radioactive material, taking into account relevant recommendations and functions of the International Atomic Energy Agency.

Upon seizing or otherwise taking control of radioactive material, devices or nuclear facilities, following the commission of an offence the State Party in possession of such items shall (a)take steps to render harmless the radioactive material, device or nuclear facility; (b) ensure that any nuclear material is held in accordance with applicable International Atomic Energy Agency safeguards; and (c) have regard to physical protection recommendations and health and safety standards published by the International Atomic Energy Agency

6.0 NUCLEAR MATERIAL ACCOUNTANCY

Nuclear material accountancy is defined as the practice of nuclear material accounting as implemented by the facility operator and the State System of accounting for and control of nuclear material (SSAC) to satisfy the requirements in the safeguards agreement between the IAEA and the State (or group of States); and as implemented by the IAEA to independently verify the correctness of the nuclear material accounting information in the facility records and the reports provided by the SSAC to the IAEA.

6.1 State System of accounting for and control of nuclear material (SSAC)

The SSAC corresponds to legal, technical and organizational arrangements that may have a national and an international objective:

A national objective to account for and control nuclear material in the State and to contribute to the detection of possible losses or unauthorized use or removal of nuclear material; and

An international objective to provide the essential basis for the application of IAEA safeguards pursuant to the provisions of an agreement between the State and the IAEA.

To achieve the above objectives, the SSAC should function at the State authority level as well as at the facility level.

The State System of Accounting for and Control of Nuclear Material (SSAC) comprises the organizational arrangements at the national level which may have both a national objective to account for and control nuclear material in the State and an international objective to provide the basis for the application of IAEA safeguards under an agreement between the State and the IAEA. Under a comprehensive safeguards agreement, the State is required to establish and maintain a system of accounting for and control of nuclear material subject to safeguards under the agreement. The system shall be based on a structure of material balance areas," and shall make provision for the establishment of such measures as:

- A measurement system for the determination of the quantities of nuclear material received, produced, shipped, lost or otherwise removed from inventory, and the quantities on inventory
- The evaluation of precision and accuracy of measurements and the estimation of measurement uncertainty
- Procedures for identifying, reviewing and evaluating differences in shipper/ receiver measurements
- Procedures for taking a physical inventory
- Procedures for the evaluation of accumulations of unmeasured inventory and unmeasured losses
- A system of records and reports showing, for each material balance area, the inventory of nuclear material and the changes in that inventory including receipts into and transfers out of the material balance area
- Provisions to ensure that the accounting procedures and arrangements are being operated correctly
- Procedures for the provisions of reports to the Agency

7.0 NUCLEAR SECURITY AND PHYSICAL PROTECTION

The objectives of the State's physical protection regime, which is an essential component of the State's nuclear security regime, should be:

To protect against unauthorized removal- Protecting against theft and other unlawful taking of nuclear material

To locate and recover missing nuclear material: Ensuring the implementation of rapid and comprehensive measures to locate and, where appropriate, recover missing or stolen nuclear material.

To protect against sabotage: Protecting nuclear material and nuclear facilities against sabotage.

To mitigate or minimize effects of sabotage- Mitigating or minimizing the radiological consequences of sabotage

The State's physical protection regime should seek to achieve these objectives through:

- Prevention of a malicious act by means of deterrence and by protection of sensitive information;
- Management of an attempted malicious act or a malicious act by an integrated system of detection, delay, and response;
- Mitigation of the consequences of a malicious act
- The objectives mentioned above should be addressed in an integrated and coordinated manner taking into account the different risks covered by nuclear security.

7.1 State responsibility

The responsibility for the establishment, implementation and maintenance of a physical protection regime within a State rests entirely with that State.

The State's physical protection regime is intended for all nuclear material in use and storage and during transport and for all nuclear facilities

The State should ensure the protection of nuclear material and nuclear facilities against unauthorized removal and against sabotage

The State's physical protection regime should be reviewed and updated regularly to reflect changes in the threat and advances made in physical protection approaches, systems, and technology, and also the introduction of new types of nuclear material and nuclear facilities

Responsibilities during International Transport

A State's responsibility for physical protection should be determined either by the borders of its sovereign territory or the flag of registration of the transport vessel or aircraft.

Transport should extend to the carriage of material on board ships or aircraft registered to that State while in international waters or airspace and until the receiving State acquires jurisdiction.

The State's physical protection regime should ensure that nuclear material is always under the jurisdiction and continuous control of the State and that the point at which responsibility for physical protection is transferred from one State to another and from one carrier to another is clearly defined and implemented by all concerned. International transport operations should be overseen by one or more government organizations having the relevant authority and competence in transport security and/or the appropriate mode of transport

The shipping State should consider, before allowing international transport, if the States involved in the transport, including the transit States:

-Are Parties to the Convention on the Physical Protection of Nuclear material.

-Have concluded with it a formal agreement which ensures that physical protection arrangements are implemented in accordance with internationally accepted guidelines; or

-Formally declare that their physical protection arrangements are implemented according to internationally accepted guidelines; or

-Have issued licenses or other authorizing documents which contain appropriate physical protection provisions for the transport of nuclear material.

7.2 Assignment of physical protection responsibilities

The State should clearly define and assign physical protection responsibilities within all levels of involved governmental entities including response forces and for operators and, if appropriate, carriers. Provision should be made for appropriate integration and coordination of responsibilities within the State's physical protection regime. Clear lines of responsibility should be established and recorded between the relevant entities especially where the entity responsible for the armed response is separate from the operator.

7.3 Legislative and regulatory framework

- The State is responsible for establishing and maintaining a legislative and regulatory framework to govern physical protection. This framework should provide for the establishment of applicable physical protection requirements and include a system of evaluation and licensing or other procedures to grant authorization. This framework should include a system of inspection of nuclear facilities and transport to verify compliance with applicable requirements and conditions of the license or other authorizing document, and to establish a means to enforce applicable requirements and conditions, including effective sanctions.
- A State should take appropriate measures within the framework of its national law to establish and ensure the proper implementation of the State's physical protection regime.
- The State should define requirements - based on the threat assessment or design basis threat for the physical protection of nuclear material in use, in storage, and during transport, and for nuclear facilities depending on the associated consequences of either unauthorized removal or sabotage
- The State should ensure that the more stringent requirements for physical protection either those against unauthorized removal or those against sabotage are applied.
- The State's legislation should provide for the comprehensive regulation of physical protection and include a licensing requirement or other procedures to grant authorization. The State should promulgate and review its regulations for the physical protection of nuclear material and nuclear facilities regularly
- The regulations should be applicable to all such materials and facilities regardless of whether under State or private ownership.
- The State should license activities or grant authorization only when such activities comply with its physical protection regulations. The State should

make provisions for a detailed examination, made by the State's competent authority, of proposed physical protection measures in order to evaluate them for approval of these activities prior to licensing or granting authorization, and whenever a significant change takes place, to ensure continued compliance with physical protection regulations.

- The State should ensure that evaluations include exercises to test the physical protection system, including the training and readiness of guards and/or response forces

7.4 requirements (conditions) for Kenya to develop nuclear energy capability

The country should first enact legislative and regulatory framework to govern the development of nuclear energy. The framework should in co-operate the requirements of both the UN charter and IAEA on nuclear safety and regulation

Secondly, the country should establish or designate a competent authority which is responsible for the implementation of the legislative and regulatory framework, and is provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities. It should take steps to ensure an effective independence between the functions of the competent authority and those of any other body in charge of the promotion or utilization of nuclear energy.

Kenya's competent authority should have a clearly defined legal status and be independent from applicants/operators/shippers/carriers and have the legal authority to enable it to perform its responsibilities and functions effectively.

The competent authority should have access to information from the its system for nuclear material accountancy and control

The competent authority should also be responsible for verifying continued compliance with the physical protection regulations and license conditions through regular inspections and for ensuring that corrective action is taken, when needed.

To ensure that physical protection measures are maintained in a condition capable of meeting the Kenya's regulations and of effectively responding to the its requirements for physical protection, the State's competent authority should ensure that evaluations based on performance testing are conducted by operators at nuclear facilities and, as appropriate, by shippers and/or carriers for transport

Evaluations should be reviewed by the State's competent authority, and should include administrative and technical measures, such as testing of detection, assessment, delay and communications systems, and reviews of the implementation of physical protection procedures. When deficiencies are identified, the competent authority should ensure that corrective action is taken by the operator, shipper and/or carrier.

8.0 EMERGENCY PLANNING AND VISIT TO THE INCIDENT AND EMERGENCY CENTRE

The Incident and Emergency Centre (IEC) is the global focal point for emergency preparedness and response for nuclear and radiological safety or security related incidents, emergencies, threats or events of media interest. The IEC is also the world's Centre for coordination of international assistance in emergency preparedness and response.

Functions

The major IEC functions include:

- Developing EPR-related safety standards, guides and tools to support Member States and international organizations; developing methodologies for crisis and consequence management
- Providing, upon request, appraisal services and assisting Member States in strengthening their EPR capabilities and arrangements
- Developing, implementing and sustaining a comprehensive EPR capacity building programme; providing assistance to Members States in their capacity building efforts and ensuring the Secretariat's staff members are capable to respond effectively
- Developing and maintaining the inter-agency EPR framework

- Providing a focal point for emergency response including provision of emergency assistance, upon request

Irrespective of the cause, the IEC prepares for and responds to nuclear or radiological incidents and emergencies, which occur in relation to a facility or an activity.

The relevant facilities and activities include, amongst others:

- Any nuclear reactor
- Any nuclear fuel cycle facility
- Any radioactive waste management facility
- The transport and storage of nuclear fuel or radioactive waste
- The manufacture, use, storage, disposal and transport of radioisotopes for agricultural, medical and related scientific and research purposes, as appropriate
- The use of radioisotopes for power generation in space objects

9.0 HUMAN RESOURCE DEVELOPMENT

The nuclear industry relies heavily on a specialized and highly trained workforce for its safety and sustainability. The management of these human resources requires particular attention, due to the high standards of competence and performance required, and the considerable time needed to develop such specialists.

The IAEA supports Member States operating, expanding or developing new nuclear power programmes in acquiring and maintaining competent staff for all nuclear organizations and for all phases of the life cycle of a nuclear facility.

9.1 Supporting Human Resource Development

This support takes the form of human resources guidance documents and reports, the provision of workshops and review services and the development and implementation of workforce and training planning tools, and e-learning modules.

Nuclear industry experience shows that within nuclear power plants, 80% of significant events can be attributed to human error. Monitoring and continually improving human performance has now become one of the key challenges in the management of human resources for a nuclear facility.

A new report has been developed to provide practical guidance in this area and assist Member States to review and improve the systems and process for improving human performance as a major contribution to sustaining and improving the performance of nuclear facilities.

9.2 Recommendations

Recommendations on competence and sustainability-related Human Resource Development (HDR) risks for emerging market nations looking to enter the civil nuclear sector.

These recommendations are:

- Human Resource Development should be a central part of a new nuclear energy state's strategy
- Human Resource Development programs should place a large emphasis on safety culture
- Quality control initiatives should include merit-based recruitment, international benchmarking and vendor involvement

- Stakeholder engagement should be a core element of new nuclear energy programs' HRD strategies

- Human Resource Development strategies should be designed around the operational needs of the nuclear industry rather than around high-profile academic programs

- New nuclear energy states adopting new reactor technologies should allocate additional HRD time and resources to become an "intelligent customer"

- National quota policies should be flexible to the needs of new nuclear programs

- Regional cooperation should not be relied upon as the primary or major source for HRD in the nuclear sector

10.0 FUNDING AND FINANCING

Nuclear power plants share many of the characteristics of other large capital intensive infrastructure projects, but have been perceived as having certain special and perhaps unique features which impact financing.

The main features of nuclear power projects

- High capital cost, long construction period and long returns on investment;
- High level of regulatory requirements and scrutiny, high safety standards, insurance and physical security;
- Long term government commitment and public support;
- Underpinning technical and human resources due to high requirements regarding operator qualifications

10.1 Key influencing factors and their implications

This section identifies the various factors which influence risk associated with the ability to finance a project.

The principal risks fall into one of three categories:

- Political, legal and regulatory factors;
- Technical factors;
- Commercial and financial factors

10.2 Political, legal and regulatory

Factors affecting financing of nuclear power are derived from national policy adherence to international treaties and agreements, government commitment and public support, and national regulatory organizations.

The government has an important role to play in meeting international obligations deriving from international legal instruments adopted in the fields of nuclear safety, security and non-proliferation.

10.3 Technical factors

History shows that the development cost of nuclear power plants to reach the present level of technological maturity has been enormous. Four decades of research, development and capital expenditure on the scale of national budgets has been expended by those countries now operating nuclear plants. The corollary is that, during this time, the nuclear industry has been continuously subject to pressures to reduce capital costs and improve safety. Competitive generation costs have become an increasingly dominant driver. The result is that the fewer numbers of designs now available on the open market have the benefit of technology maturity, safety characteristics and features built on worldwide experience and at a cost base that is controlled and predictable for repeated units.

Experience from earlier designs has been used to develop cost effective manufacturing and deployment of nuclear reactors.

10.4 Commercial and financial factors:

The provision of debt for a nuclear power project is in principle no different than any other major infrastructure project. Debt is needed to pay project costs, including design, manufacture of components, procurement, construction, installation and commissioning. A return on investment to recover debt is established from the operation of the completed project.

11.0 MECHANISMS TO REDUCE INVESTMENT RISKS FOR NUCLEAR POWER PROJECTS

This section identifies specific mechanisms whereby risks can be controlled and mitigated. This is particularly important for the first nuclear power unit and risk profiles should progressively change and moderate for second and subsequent units as knowledge and experience build.

11.1 Political, legal and regulatory mechanisms

Even without providing direct financing of nuclear power projects, the government is seen as playing a central role in any decision to adopt or restart a nuclear project. Government involvement and support is crucial in a number of areas, such as:

- Supporting the adoption of nuclear energy;
- Ensuring manageable transparency of a nuclear programme;
- Becoming a party to relevant international legal instruments in the field of nuclear safety, security and non-proliferation;
- Enacting national legislation, establishing necessary regulatory, legal, insurance and other institutional arrangements to support and control nuclear power and implement international treaty obligations;
- Encouraging public acceptance of the overall benefits of nuclear power;
- Creating a national climate in favour of investing in nuclear power to encourage investor confidence;
- Providing or actively supporting the provision of suitable sites for nuclear power plants and for repositories, including handling the practical

processes for selection, evaluation, planning (site approval), licensing (safety approval) and preparation;

- Establishing a strategy and defining responsibilities for management of wastes arising both during operation and decommissioning, as well as for spent fuel management;
- Ensuring a regulatory process which meets the high and internationally agreed levels of nuclear safety;
- Providing conditions to investors or owner/operators wishing to invest in nuclear power, including financial guarantees of their performance, power sale conditions etc., particularly for the first unit;
- Providing support for education programmes to develop in a timely manner required personnel for the overall programme;
- Recognizing the need to ensure confidence in long term returns especially for investors in a deregulated electricity supply market, and;
- Fostering and actively encouraging the development of an effective safety culture, particularly through appropriate educational, development and international exchange programmes.

11.2 Conclusions on nuclear funding

Nuclear power plants require high levels of scientific, engineering and management knowledge and the highest levels of safety and security in a business which has existed for only 50 years. Therefore, nuclear power projects provide a most significant challenge to those able and willing to finance them.

After several decades in which few nuclear power plants were ordered, there appears to be the possibility of a worldwide renaissance. This is driven by a number of factors but principally increasing global power needs, rising fossil fuel costs, the desire for a diverse and secure energy supply and recognition of the potential environmental benefits of an energy source with little or no carbon emissions.

There are three broad areas which must be addressed in order to improve the prospects for investing in nuclear power reactor construction.

The first area, and probably most important, is government and utility commitment and preparedness for the adoption and implementation of nuclear power to the highest internationally recognized standards of safety.

This is seen as a sovereign activity requiring both long term national commitment and a willingness to embrace international institutions which support the development of nuclear power for peaceful uses. The issues behind required commitment and implementation, and provides guidance on necessary measures include political, legal and regulatory measures, as well as specific infrastructure conditions.

Nuclear energy has a worldwide impact and calls for the highest standards of safety. Establishing a safety culture which inspires confidence in national and international communities is essential to gaining the confidence of investors. Therefore, the establishment and operation of an effective and predictable regulatory system and process is one key to success. Only national governments can take ultimate responsibility for key strategies concerning the fuel supply and waste and spent fuel management.

The second area is application of lessons learned from technological and project developments. To date, most nuclear power plants have been, to some extent, developmental in their nature and all have been government backed, at least to some degree. A number of publications have identified measures by which confidence in design, permitting process, construction and operation of nuclear projects can be strengthened to encourage financial investment.

The third area is financing itself. Al though nuclear power plants share many of the attributes of other major projects, they have characteristics making them a greater challenge for the investment community.

Principal among these are high capital costs, technical and scheduling uncertainties, and the potentially long period before a return on investment can be secured. These, coupled with the need for investors to take into account non-financial aspects, including, for example, public acceptance, result in the need for some innovation in investment.

There is a need to consider some factors in the structuring of projects, contracts and mechanisms to ensure return on investment.

Improving the prospects for investment in the nuclear industry is, in large part, achieved by a combination of financial and strategic planning measures, which together create sufficient confidence for investors to support projects. There are also a number of wider actions that can be taken to improve prospects for investing in nuclear power. These are aimed at a higher level and are designed to promote the adoption of nuclear energy as an effective and efficient energy option. These include, for example, the benefits of formally recognizing nuclear power's virtually carbon-free characteristics and the value of encouraging international institutions, such as the World Bank and certain region al investment banks and export credit agencies, to recognize the potential contribution of nuclear power.

Others are concerned with international encouragement to maintain consistent and practical standards, methods, data and processes in the development of nuclear power and with the establishment of appropriate safety cultures in countries wishing to adopt nuclear power as an option.

12.0 NUCLEAR POWER SITING CONSIDERATIONS

12.1 Geology and seismology

Nuclear power stations must be designed to prevent the loss of safety-related functions. Generally, the most restrictive safety-related site characteristics considered in determining the suitability of a site are surface faulting, potential ground motion and foundation conditions(including liquefaction, subsidence, and landslide potential), and seismically induced floods.

12.2 Atmospheric extremes and dispersion

The potential effect of natural atmospheric extremes (e.g., tornadoes-and exceptional icing conditions-on the safety-related structures of a nuclear station must be considered.) However, the atmospheric extremes that may occur at a site are not normally critical in determining the suitability of a site because safety-related structures, systems, and components can be designed to withstand most atmospheric extremes.

12.3 Population considerations

Reactors should be located away from very densely populated centers; areas of low population density are generally preferred. In determining the acceptability of a particular site located away from a very densely populated center, consideration will be given to safety, environmental, economic, or other factors that may result in the site being found acceptable.

12.4 Emergency planning

Physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans must be identified. It requires reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency before an operating license for a nuclear power plant can be issued. Adequate plans must be developed for two areas or Emergency Planning Zones (EPZs). The exact size and configuration of the EPZs should be determined in relation to local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries.

12.5 Security plans

Site characteristics must be such that adequate security plans and measures can be developed." Security plans and measures are important to prevent plant damage and possible radiological consequences to members of the public as a result of acts of sabotage.

12.6 Hydrology which includes

Water Availability- The availability of essential water during periods of low flow or low water level is an important initial consideration for identifying potential sites on rivers, small shallow lakes, or along coastlines. Both the frequency and duration of low flow or low-level periods should be determined from the historical record and, if the cooling water is to be drawn from impoundments, from projected operating practices.

Water Quality-The following are examples of potential environmental effects of station construction and operation that must be assessed: physical and chemical environmental alterations in habitats of important species, including plant-induced rapid changes in environmental conditions; changes in normal current direction or velocity of the cooling water source and receiving water; scouring and siltation resulting from construction and cooling water intake and discharge; alterations resulting from dredging and spoil disposal; and interference with shoreline processes.

12.7 Industrial, military, and transportation facilities

Accidents at nearby industrial facilities such as chemical plants, refineries, mining and quarrying operations, oil or gas wells, or gas and petroleum product storage installations may produce missiles, shock waves, flammable vapor clouds, toxic chemicals, or incendiary fragments. These may affect the station itself or the station operators in a way that jeopardizes the safety of the station.

Accidents at nearby military facilities, such as munitions storage areas and ordnance test ranges, may threaten station safety. An otherwise unacceptable site may be shown to be acceptable if the cognizant military organization agrees to change the installation or mode of operation to reduce the likelihood or severity of potential accidents involving the nuclear station to an acceptable level.

12.8 Land use and aesthetics

The following national agencies should be consulted for the special areas prior to choice

- National Park Service
- National Museums
- Forest services

- Rivers and Lakes Management Authority
- Fisheries Department
- Recreational Areas

12.9 Lessons learned

Social and economic issues are important determinants of siting policy. It is difficult both to assess the nature of the impacts involved and to determine value schemes for predicting the level or the acceptability of potential impacts.

The siting, construction, and operation of a nuclear power station may have significant impacts on the socioeconomic structure of a community and may place severe stresses on the local labor supply, transportation facilities, and community services in general. There may be changes in the tax basis and in community expenditures, and problems may occur in determining equitable levels of compensation for persons relocated as a result of the station siting. It is usually possible to resolve such difficulties by proper coordination with impacted communities; however, some impacts may be locally unacceptable and too costly to avoid by any reasonable program for their mitigation. Evaluation of the suitability of a site should therefore include consideration of purpose and probable adequacy of socioeconomic impact mitigation plans for such economic impacts on any community where local acceptance problems can be reasonably foreseen.

Certain communities in the neighborhood of a site may be subject to unusual impacts that would be excessively costly to mitigate. Among such communities are towns that possess notably distinctive cultural character, i.e., towns that have preserved or restored numerous places of historic interest, have specialized in an unusual industry or vocational activity, or have otherwise markedly distinguished themselves from other communities.

Siting decisions should reflect fair treatment and meaningful involvement of all people, regardless of race, ethnicity, culture, income or educational level to assure equitable consideration and to minimize disproportionate effects on minority and low-income population.

13.0 VISIT TO DUKOVANY NUCLEAR POWER PLANT IN CZECH REPUBLIC

13.1 The Dukovany Nuclear Power Station

The Dukovany Nuclear Power Plant is situated approximately 30 km southeast of Třebíč in a triangle formed by the municipalities of Dukovany, Slavětice and Rouchovany. Four pressurized-water reactors of Type VVER 440 – Model V 213, each of these reactors has the heat capacity of 1,375 MW and electric capacity of 510 MW.

The Dukovany Nuclear Power Plant is intended for a base-load operation mode. It annually supplies approximately 13 TWhr of electric energy to the national power network. Particular attention is paid to the safety of its operation which is supervised on on-going bases by the State Office on Nuclear Safety and relevant international organisations.

The reactors are fuelled by uranium dioxide UO_2. Fuel is placed in the reactor in 312 fuel assemblies. Each assembly consists of 126 fuel rods with a hermetically sealed fuel. In addition, the reactor contains 37 control rod assemblies with the fuel part. Improved nuclear fuel parameters enabled a smooth transition in 1997 from a three- to four-year fuel cycle, and since 2003 five-year cycle have been successively started.

13.2 Engineering and technology

Four pressurized-water reactors (PWR) are installed in the Dukovany Nuclear Power Plant. The design-mark of these reactors is VVER 440/213. The abbreviation VVER (in Czech) means Water-cooled, Water-moderated Energy Reactor. Each of these reactors has the heat capacity of 1,375 MW and electric capacity of 510 MW.

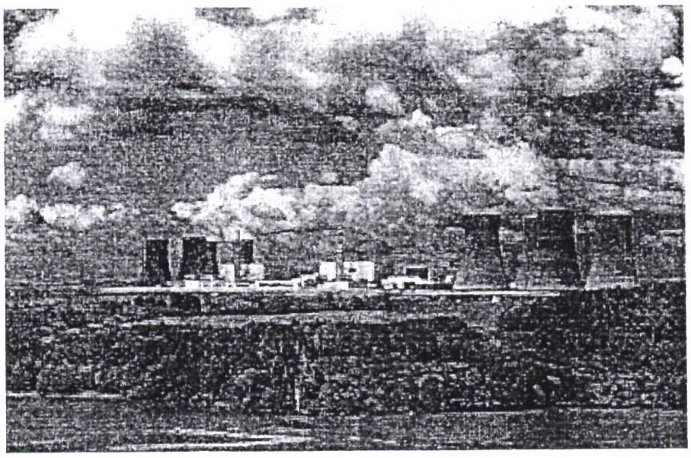

Figure 1.1 Dukovany nuclear power plant in Czech Republic

The layout of the power plant includes two main production units. Each of them contains two reactors and all directly linked equipment, including the machine hall with turbines and generators.

13.3 Dukovany Nuclear Power Plant Safety

The safety of the nuclear power plant is achieved by the design safety and the power plant's operational culture level, which includes qualified personnel, quality documentation, use of operating experience, technical control, protection against radiation, fire safety, etc.

Safe design - Nuclear power plant equipped with VVER 440/213 reactors have some important design advantages. For example, the pressure vessel of the reactor and the primary circuit piping include a very small content of cobalt. This results in a lower activation of material and a lower irradiation of personnel. Strong feedback during output operation of the reactor ensures the reactor stability without xenon oscillations.

Safe operation of the power plant is ensured by six shifts of the same standard. The control shift personnel – operators in the unit control room – consist of seven shifts. The seventh shift is formed due to the high demands that are made on periodic training of the control personnel. The highest shift chief of the entire nuclear power plant is the shift engineer. Each of the four reactor units is controlled from the independent unit control room. The attendance of the unit control room includes the reactor unit chief, primary part operator and the secondary part operator.

Inspections of technical conditions in the power plant are conducted by the power plant employees as well as independent supervision bodies and inspection institutions. Technical inspections are performed regularly by trained workers in accordance with the pre-approved procedures. The latest technologies are used during technical inspections. The most stringent inspections are focused on the facilities that are important in view of nuclear safety. The nuclear safety of the nuclear power plant is not determined by its actual condition at the time of final inspection before its commissioning.

Safety systems - The basic precondition of power plant safety is the continuous removal of heat generated in the reactor core. The safety systems of the Dukovany Nuclear Power Plant consist of high- and low-pressure emergency pumps, sprinkler system pumps, reservoirs with boric acid solution, heat exchangers, pressurized-water containers, pipelines, fittings, barbotage (condensing) troughs, barbotage towers and gas tanks. In case of accidents connected with the leakage of cooling water from the primary circuit, the pressure of the primary circuit cooling water would be reduced while the steam pressure in the hermetic boxes would simultaneously be increased

13.4 Team taken to all sections of the plant

The team was taken around the nuclear plant by the operations engineer who had been with the plant since its establishment. The team was informed that the biggest challenge in managing the plant was to ensure total safety and security of plant operations and the issue of nuclear waste disposal. The team was taken to a specially built go down where nuclear wastes was stored in steel ganisters and monitored in 24/7 basis. The team was informed that the cost of nuclear waste storage is borne by the government and will take thousands of years.

14.0 VISIT TO COMPREHENSIVE TEST BAN TREATY ORGANIZATION

The Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is an international organization that will be established upon the entry into force of the Comprehensive Nuclear-Test-Ban Treaty, a Convention that outlaws nuclear test explosions. Its seat will be Vienna, Austria. The organization will be tasked with verifying the ban on nuclear tests and will operate therefore a worldwide monitoring system and may conduct onsite inspections. The Preparatory Commission for the CTBTO, and its Provisional Technical Secretariat, were established in 1997 and are headquartered in Vienna, Austria.

States Parties to the Treaty are encouraged to conduct a Consultation and Clarification process (C&C) before requesting an on-site inspection. The state that has concerns about an ambiguous event should, whenever possible, make any effort to clarify it through consultations with the state in whose territory this event occurred, either directly or through the Organization.

14.1 Civil and Scientific Uses of CTBTO Data

The huge amount of data collected by the CTBTO can also be used for purposes other than detecting nuclear explosions, particularly in the field of disaster mitigation and early warning. In 2006, the CTBTO started providing seismic and hydro acoustic data directly to tsunami warning centers. As of 2012, data is shared with tsunami warning centers in eight countries, mainly in the Indo-Pacific region.

Throughout the Fukushima Daiichi nuclear disaster of March 2011, the CTBTO's radionuclide stations tracked the dispersion of radioactivity on a global scale. More than 1600 detections of radioactive isotopes from the crippled nuclear reactor were picked up by over 40 CTBTO radionuclide monitoring stations. The CTBTO shared its data and analysis with its 183 Member States, as well as international organizations and some 1,200 scientific and academic institutions in 120 countries.

The CTBTO also recorded the infrasound produced in the atmosphere by the meteor explosion over Chelyabinsk, Russia in 2013. Seventeen stations around the world, including one in the Antarctic, recorded the event as the infrasound reverberated around the world multiple times

Recordings from CTBTO hydrophones were analyzed to determine an impact location for Air France Flight 447 and Malaysia Airlines Flight 370, both of which were lost without a known crash site. No data was detected in the event of Flight 447, even after it was reassessed once the location of the wreckage was known. As of July 2014, Flight 370 remains missing with no known crash site or confirmed debris. Since the only evidence for Flight 370's final resting site comes from an analysis of its satellite transmissions, which has resulted in an imprecise and very large search area, hydro acoustic recordings from CTBTO were analyzed to potentially determine and locate its impact with the Indian Ocean. Analysis of available hydro acoustic recordings (including those made by a CTBTO hydrophone located off Cape Leeuwin, Western Australia) identified one event which may be associated with Flight 370

15.0 OBSERVATIONS BY THE DELEGATION

The delegation made the following observations

15.1 Advantages of Nuclear Energy

Lower Greenhouse Gas Emissions: As per the UN reports in 1998, it has been calculated the emission of the greenhouse gas has reduced for nearly half due to the popularity in the use of nuclear power. Nuclear energy by far has the lowest impact on the environment since it does not release any gases like carbon dioxide, methane which are largely responsible for greenhouse effect. Though some greenhouse gases are released while transporting fuel or extracting energy from uranium.

Powerful and Efficient: The other main advantage of using nuclear energy is that it is very powerful and efficient than other alternative energy sources. Advancement in technologies has made it more viable option than others. This is one the reason that many countries are putting huge investments in nuclear power. At present, a small portion of world's electricity comes through it.

Reliable: Unlike traditional sources of energy like_solar and wind which require sun or wind to produce electricity, nuclear energy can be produced from nuclear power plants even in the cases of rough weather conditions. They can produce power 24/7 and need to be shut down for maintenance purposes only.

Cheap Electricity: The cost of uranium which is used as a fuel in generating electricity is quite low. Also, set up costs of nuclear power plants is relatively high while running cost is low. The average life of nuclear reactor range from 4-60 years depending on its usage. These factors when combined make the cost of producing electricity very low. Even if the cost of uranium rises, the increase in cost of electricity will be much lower.

Low Fuel Cost: The main reason behind the low fuel cost is that it requires little amount of uranium to produce energy. When a nuclear reaction happens, it releases million times more energy as compared to traditional sources of energy.

Supply: There are certain economic advantages in setting up nuclear power plants and using nuclear energy in place of conventional energy. It is one of the major sources of electricity throughout the nation. The best part is that this energy has a continuous supply. It is widely available, has huge reserves and expected to last for another 100 years while coal, oil and natural gas are limited and are expected to vanish soon.

Easy Transportation: Production of nuclear energy needs very less amount of raw material. This means that only about 28 gram of uranium releases as much energy as produced from 100 metric tons of coal. Since it's required in small quantities, transportation of fuel is much easier than fossil fuels. Optimal utilization of natural resources in production of energy is a very thoughtful approach for any nation. It not only enhances the socio-economic condition but also sets example for the other countries

15.2 Disadvantages of nuclear energy

1. Raw Material

Uranium is used in the process of fission because it's a naturally unstable element. This means that special precautions must be taken during the mining, transporting and storing of the uranium, as well as the storing of any waste product to prevent it from giving off harmful levels of radiation.

2. Water Pollutant

Nuclear fission chambers are cooled by water. This water is then turned into steam, which is used to power the turbines. When the water cools enough to change back into liquid form, it is pumped outside into nearby wetlands. While measures are taken to ensure that no radiation is being pumped into the environment, other heavy metals and pollutants can make their way out of the chamber. The immense heat given off by this water can also be damaging to eco systems located nearby the reactor. Nuclear powered ships and submarines pose a danger to marine life and the environment. Old vessels can leak radiation if they are not maintained properly or if they are dismantled carelessly at the end of their working lives.

3. Waste

When the uranium has finished splitting, the resulting radioactive by products needs to be removed. While recycling efforts of this waste product have been undertaken in recent years, the storage of the byproduct could lead to contamination through leaks or containment failures.

4. Leaks

Nuclear reactors are built with several safety systems designed to contain the radiation given off in the fission process. When these safety systems are properly installed and maintained, they function adequately. When they are not maintained, have structural flaws or were improperly installed, a nuclear reactor could release harmful amounts of radiation into the environment during the process of regular use. If a containment field were to rupture suddenly, the resulting leak of radiation could be catastrophic. Some fear that living in these areas can damage their health, especially the health of young children.

5. Shutdown Reactors

There have been several nuclear reactors that have failed and been shut down that are still in existence. These abandoned reactors are taking up valuable land space, could be contaminating the areas surrounding them, and yet are often too unstable to be removed

There have been serious accidents with a small number of nuclear power stations. The accident at Chernobyl (Ukraine) in 1986, led to 30 people being killed and over 100,000 people being evacuated. In the preceding years another 200,000 people were resettled away from the radioactive area. Radiation was even detected over a thousand miles away in the UK as a result of the Chernobyl accident. It has been suggested that over time 2500 people died as a result of the accident. Many Governments fear that unstable countries that develop nuclear power may also develop nuclear weapons and even use them.

16.0 LEGISLATIVE AND NUCLEAR SAFETY LEGAL INSTRUMENTS

There is no single international instrument that addresses nuclear security in a comprehensive manner. The legal foundation for nuclear security comprises of international instruments and recognized principles designed to control nuclear material and other radioactive substances. This broad range instruments (many developed under IAEA auspices) provides a framework for using such material safely and securely in ways that protect all States - both those with active nuclear programmes and those conducting only limited nuclear activities.

While responsibility for nuclear security rests entirely with each Member State, a number of States have not adhered to relevant instruments or implemented them effectively through their national legal and regulatory frameworks. This situation leaves gaps in the global system that can be exploited by terrorist or criminal elements.

16.1 Nuclear Energy Safety and Regulations

Nuclear energy has a worldwide impact and calls for the highest standards of safety. Establishing a safety culture which inspires confidence in national and international communities is essential to gaining the confidence of investors. Therefore, the establishment and operation of an effective and predictable regulatory system and process is one key to success. Only national governments can take ultimate responsibility for key strategies concerning the fuel supply and waste and spent fuel management.

16.2 Establishment of nuclear power station

To date, most nuclear power plants have been, to some extent, developmental in their nature and all have been government backed, at least to some degree. Kenya needs to identify a number of measures by which confidence in design, permitting process, construction and operation of nuclear projects can be strengthened to encourage financial investment.

The key factors in choosing nuclear reactor design include fuel procurement, spent fuel and waste management. With regard to fuel, the availability of several competitive suppliers for the various raw materials and services needed to produce the nuclear fuel required for a given reactor design, such as the procurement of the fissionable raw material, enrichment services, and fuel fabrication, should also be considered. These are very expensive and will need a long term development plan for a developing nation like Kenya. As for spent fuel and waste management, long term plans are needed.

16.3 Human Resource development

The nuclear industry relies heavily on a specialized, highly trained and disciplined workforce for its safety and sustainability. The management of these human resources requires particular attention due to the high standard of competence and performance required and the considerable time needed to develop such specialists. Currently Kenya has no nuclear power specialists or capability.

16.4 Stakeholder Consultations in Siting Considerations

We cannot however ignore the role of stakeholders in the project. Stakeholders will have a range of opinions regarding the proposal, operation, expansion or closure of a nuclear facility, based in part on whether they are national or local in nature and on which of the many perspectives a stakeholder holds: elected officials, business interests, environmentalists, emergency planners, educators, interested citizens, or workers. And, when conducted well, the process normally yields indisputable benefits. Both completed and ongoing projects have demonstrated that a properly tailored process that promptly involves all stakeholders, is thorough in its communication, and includes meaningful interaction, should result in better long-term decisions and prevent unnecessary delays. Although decision making processes vary considerably by Member State, depending on culture, history and governmental structure, it is nonetheless advisable that all entities primarily responsible for nuclear programmes create plans for stakeholder involvement. There is no one ideal model for stakeholder involvement. The stakeholder involvement strategies and approaches depend on the nature of the nuclear facility, the point in its life cycle, cultural and legal norms and other factors.

Nuclear energy has its positive aspects but the negative aspects outweigh the positive ones. Therefore before its adoption Kenya should take into considerations all the pros and cons and implement the most suitable option while looking into social, economic and political factors brought by nuclear energy