EVOLUTION OF RADIATION SAFETY CULTURE IN AFRICA: IMPACT OF THE CHERNOBLY ACCIDENT

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INTRODUCTION 1/4

• Safety Culture is: The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance. (IAEA Glossary)

• Radiation Safety Infrastructure is a necessary condition but not sufficient for the emplacement of Radiation Safety Culture
INTRODUCTION 2/4

• Radiation Safety Culture is the fabric woven from the different fibres of Radiation Safety Infrastructure:
  ➢ Legislation to ensure safety
  ➢ Institution (Regulatory Body) established by legislation to:
    ☐ Make Regulations, safety principles
    ☐ Carry out inspections;
    ☐ Authorize practices and facilities;
    ☐ Enforce safety regulations
  ➢ The Regulatory Body should be:
    ☐ Effectively independent;
    ☐ Adequately funded
    ☐ Staffed by competent people;
    ☐ Able to have its own organizational structure
    ☐ Able to have a Management System;
  ➢ The Regulatory Body should be empowered to:
    ☐ Coordination
    ☐ Advisory Bodies
    ☐ Interaction with licensee
    ☐ Interact with other national and international bodies with similar objectives
INTRODUCTION 3/4

Needs for Radiation Safety Infrastructure in Africa

• Activities carried out in Africa
  – Health Sector  - DR, RT, NM
  – Mining Sector  - NDT, NG, RTT
  – Petroleum Sector  - NDT, NWL, NG, RTT
  – Manufacturing Sector  - NG, RTT
  – Agriculture & Animal Husbandry  - NG, SIT,
  – Education and Research
  – Nuclear Reactor Operation  - 8 No. NRR
  – Nuclear Power – 2 No. in operation & 10 MS planning NPP

• Effect of the activities carried out outside Africa
• 54 Member States in the African Union
• 1986 - 27 MS in the IAEA
• 2016 – 44 MS in the IAEA
• All participate in TC Program
• According to the INSAG Report, the Chernobyl accident of April 1986 was the product of a lack of safety culture due to a flawed reactor design that was operated with inadequately trained personnel.
• The operating personnel did not comply with operational procedures.
• The combination of these factors provoked a nuclear accident of maximum severity in which the reactor was totally destroyed within a few seconds.
• The resulting steam explosion and fires released at least 5% of the radioactive reactor core into the atmosphere and downwind – some 5200 PBq (I-131 eq).
• Geography (Africa and Chernobyl (Europe) are in the same hemisphere but in the southern part)
• Climate (Accident happened in April when the wind direction was SW-NE)
• Two Chernobyl plant workers died on the night of the accident, and a further 28 people died within a few weeks as a result of acute radiation poisoning. Nobody died in Africa from the accident.
• Africa was saved from the immediate impact of the nuclear fallout by geography and climate.
• But not for long!!!
• 1988 - import of contaminated beef
• 1990 - import of powdered milk
• Several countries with or without the appropriate infrastructure embarked on food monitoring for radioactive contamination
• 1991 - the Bamako Convention on the Ban of the Import into Africa and Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa (1991);
INTERNATIONAL RESPONSE 1/2

- **Conventions**
- **Standards**
  - BSS
  - Guides
- **Missions**
  - **WAMAP**
  - **RAPAT**
  - Radiation Safety, and Security of Radioactive Sources, Infrastructure Appraisal (RaSSIA)
  - *Integrated Regulatory Review Service (IRRS)*
  - *Occupational Radiation Protection Appraisal Service (ORPAS)*
  - *Emergency Preparedness Review (EPREV)*
  - *Waste Safety Appraisal Service*
  - *Transport Safety Appraisal Service (TranSAS)*
  - *Education and Training Appraisal (EduTA)*
INTERNATIONAL RESPONSE 2/2

• TC Programmes and Projects on Safety
  – Model Project
  – Thematic Safety Area Programming

• Tools
  – Radiation Safety Information Management System (RASIMS)
  – Self-Assessment of Regulatory Infrastructure for Safety (SARIS)
  – Regulatory Authority Information System (RAIS)
  – Control of Sources Network
THE MODEL PROJECT 1/3

• The Model Project on the “Establishment of Radiation Protection Infrastructure” in Member Sates 1995-2004
• The Model Project was based on five Milestones set to meet the requirements of the BSS.

- **Milestone 1**: Establishment of Legislative and Regulatory Infrastructure.
- **Milestone 2**: Establishment of Occupational Exposure Control Programme
- **Milestone 3**: Establishment of Medical Exposure Control Programme
- **Milestone 4**: Establishment of Public Exposure Control Programme
- **Milestone 5**: Establishment of Emergency Preparedness and Response Programme
• The Model Project was brought to a close in 2004, but the level of achievement of the Milestones needs to be continuously assessed
  – by self, by peers in the region and finally by the international community and strive for continuous improvement of radiation safety in all applications of ionizing radiation.
  – Its end marked the ‘coming of age’ of the regulatory authorities in Africa, which was compelled by the need to consolidate and sustain the achievements of the Model Project.
  – five years later, led to the establishment of the Forum of Nuclear Regulatory Authorities in Africa in March 2008.
THE MODEL PROJECT 3/3

• ACHIEVEMENT OF THE MILESTONES IN 2005
  – New awareness in the region about radiation safety
  – Several African Member States have “mainstreamed” radiation safety
  – Stimulated direct contact among the regulatory bodies in the region
NATIONAL RESPONSE 1/2

• The Nigerian Case
  – May 1986, CERT, ABU Zaria with the support of the British Council, organized a National Conference on the Impact of the Chernobyl Nuclear Accident on Nigeria
  – 1988 Beef Shipment carrying foreign flag
    • Ship turned back with its cargo
  – 1988 Beef Shipment carrying Nigerian flag
    • Ship berthed and off loaded tonnes of frozen beef
    • CERT was directed by the Government to establish level of radioactivity in imported beef
    • Level of Sr-90 and Cs- 137
    • Government banned importation of beef and poultry
    • Government strengthened the food and drug safety legislation - an unintended consequence (benefit) of Chernobyl
In combination with the requirements of a TC project for the supply of a research reactor led to the promulgation of the *Nuclear Safety and Radiation Protection Act 19 of 1995*!; and

The establishment of the **Nigerian Nuclear Regulatory Authority** in 2001
THEMATIC SAFETY AREAS 1/6

• Thematic Safety Areas
  – TSA 1: Regulatory Infrastructure for Radiation Safety
  – TSA 2: Radiological Protection in Occupational Exposure
  – TSA 3: Radiological Protection in Medical Exposure
  – TSA 4: Public & Environmental Exposure Control
  – TSA 5: Emergency Preparedness and Response
  – TSA 6: Education and Training
  – TSA 7: Transport Safety

• Each TSA has a standard set of “essential elements” used to identify needs, identify assistance needs and monitor progress.

• **140 Countries currently (44 in Africa)**
THEMATIC SAFETY AREAS 2/6

• African Member States Member States that can be considered to have a high-level of radiation safety infrastructure:
  – Regulatory infrastructure for radiation safety -21%
  – Occupational protection - 5%
  – Protection in Medicine - 7%
  – Protection of the public and environment - 4%
THEMATIC SAFETY AREAS 3/6

International Conference on Human and Organizational Aspects of Assuring Nuclear Safety
- Exploring 30 Years of Safety Culture, Vienna, Austria
22-26 February 2016
THEMATIC SAFETY AREAS 4/6 TSA 2

The diagram shows the number of countries with different levels of progress in various thematic safety areas. The categories are:

- Regulatory Infrastructure for Protection
- Individual Monitoring for External Radiation Sources
- Individual Monitoring for Intake Radioisotopes
- Workplace Monitoring
- Services Providing
- Implementation of the Requirements by End Users
- Occupational Exposure to Natural Sources

The levels of progress are indicated by colors:
- Good progress: Green
- Medium progress: Yellow
- Limited progress: Purple
- Low progress: Red

The number of countries in each category is indicated on the diagram.
THEMATIC SAFETY AREAS 5/6 TSA 3

International Conference on Human and Organizational Aspects of Assuring Nuclear Safety - Exploring 30 Years of Safety Culture, Vienna, Austria
22-26 February 2016
THEMATIC SAFETY AREAS 6/6  

International Conference on Human and Organizational Aspects of Assuring Nuclear Safety  
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FORUM OF REGULATORY BODIES IN AFRICA –REGIONAL INITIATIVE 1/2

• Established in 2007 and held its first meeting in October 2008 in Vienna with 18 Member States and
• Approved its charter in March 2009 in Pretoria, South Africa

• The objectives of the Forum are to:
  – Provide a platform for fostering regional cooperation;
  – Provide for the exchange of expertise, information and experience;
  – Provide opportunity for mutual support and coordination of regional initiatives; and
  – Leverage the development and optimization of resource utilization.
• TWG1: Upgrading Legislative and Regulatory Infrastructure
• TWG2: Upgrading Safety in Radiotherapy
• TWG3: Upgrading Safety in Uranium Mining and Milling
• TWG4: Regulatory Framework for Licensing of Nuclear Power Plant
• TWG5: Upgrading Safety in Nuclear Research Reactor
• TWG6: Education and Training and Knowledge Management
• TWG7: Upgrading Safety of Radioactive Waste Management Infrastructure

• Identified 2 Management tools
  – Self-assessment among regulatory bodies
  – Networking among regulatory bodies
• To address both the fundamentals and the thematic safety areas
CHALLENGES 1/2

• All the available tools measure/evaluate **Radiation Safety Infrastructure** AND NOT **Radiation Safety Culture**

• RSC is a fabric with 3 dimensions of people, technology and institution

• RSI are fibres of different colours

• Weak Radiation Safety Infrastructure
  – Some have legislation but **not consistent** with International Standards
  – Some have legislation but **not implemented**
  – Some have legislation but **not enforced**
  – Some have draft legislation but **not promulgated**
  – Several have **no draft legislation**
CHALLENGES 2/2

• Different levels of regulatory infrastructure
  – RB established by law
  – RB established as an ad hoc committee not by law
  – RB lacks powers to make regulations
  – RB lacks powers to enforce radiation safety

• Dwindling Resources (IAEA & MS)

• Increased Use of Ionizing Radiation in
  – Mining
  – Human health (radiotherapy); and
  – even attraction to nuclear energy

• Low level of cooperation among RBs except through IAEA
OPPORTUNITIES

• Globalization through the use of IAEA standards
• Coming into force several international agreements and codes;
• Promotion of transparency and sharing of experience and lessons learned through the IRRS
• Establishment of the African Commission on Nuclear Energy;
• Increase in Medical Applications especially radiotherapy
• Renewed interest in mining activities
• Interest in NPP in the Region
RECOMMENDATIONS 1/2

• The IAEA needs to:
  – Develop guidance documents on Radiation Safety Culture, including how to measure it;
  – Provide more resources for training and assistance for strengthening radiation infrastructure in the region;
  – Develop innovative strategies for the achievement of the TSA tasks
  – Encourage manufacturers of radiation equipment to get involved in strengthening radiation safety infrastructure in the Region

• The MS through the General Conference should dedicate the next project cycle to consolidation of Radiation Safety Infrastructure, as a necessary condition for Radiation Safety Culture
RECOMMENDATIONS 2/2

• The African MS should, through the General Conference, seek the support of other regions to dedicate the next project cycle to consolidation of Radiation Safety Infrastructure, as a necessary condition for Radiation Safety Culture

• The African Union should operationalize the African Commission on Nuclear Energy (AFCONE) with the sole objective of emplacing a sustainable radiation safety culture throughout the Region

• The AU should encourage manufacturers of radiation equipment and mining companies to get involved in strengthening radiation safety infrastructure in the Region

• FNRBA should rediscover itself and dedicate its resources to emplacement of radiation safety culture in the region
THANK YOU