RADIOACTIVE WASTE MANAGEMENT IN GHANA; A COUNTRY CURRENTLY WITHOUT NUCLEAR POWER PLANT

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SYNOPSIS

- Background of GAEC
- Main sources of radioactive waste in Ghana
- Ghana's radioactive waste inventory
- Ghana's plan/policy for managing RW
- Infrastructure and Resource Availability
- Institutional framework for managing RW
- Management options for RW
- Disposal plan; The Borehole Disposal Concept
- Concerns, problems and challenges in managing RW

Background of GAEC

- Ghana Atomic Energy Commission (GAEC) was established in 1963 (Act 204) which has been superseded by (Act 588) 2000.

➢ Main functions include

- Develop,
- Promote and
- Ensure peaceful application of nuclear and biotechnological techniques for the socio-economic advancement of Ghana

Background of GAEC

- In pursuance of these objectives the Commission has established **key** Institutes to execute various research activities.

- National Nuclear Research Institute (NNRI)
- Biotechnology and Nuclear Agricultural Research Institute (BNARI)
- Radiation Protection Institute (RPI)
- Radiological and Medical Sciences Research Institute (RAMSRI)
- Graduate School of Nuclear and Allied Sciences (SNAS) in collaboration with the University of Ghana
- Nuclear Power Institute (In the pipe-line)

Main sources of radioactive waste in Ghana

RW in Ghana originates from three main sectors of the economy namely:

i. Industrial and Engineering Sector; Brewery, Mining, Petroleum, Aviation, Civil Engineering (Road and Dam Construction), Housing, NDT and Irradiation

ii. Medical Sector; Radiotherapy and Nuclear Medicine Units

iii. Educational and Research Sectors: Ghana Research Reactor

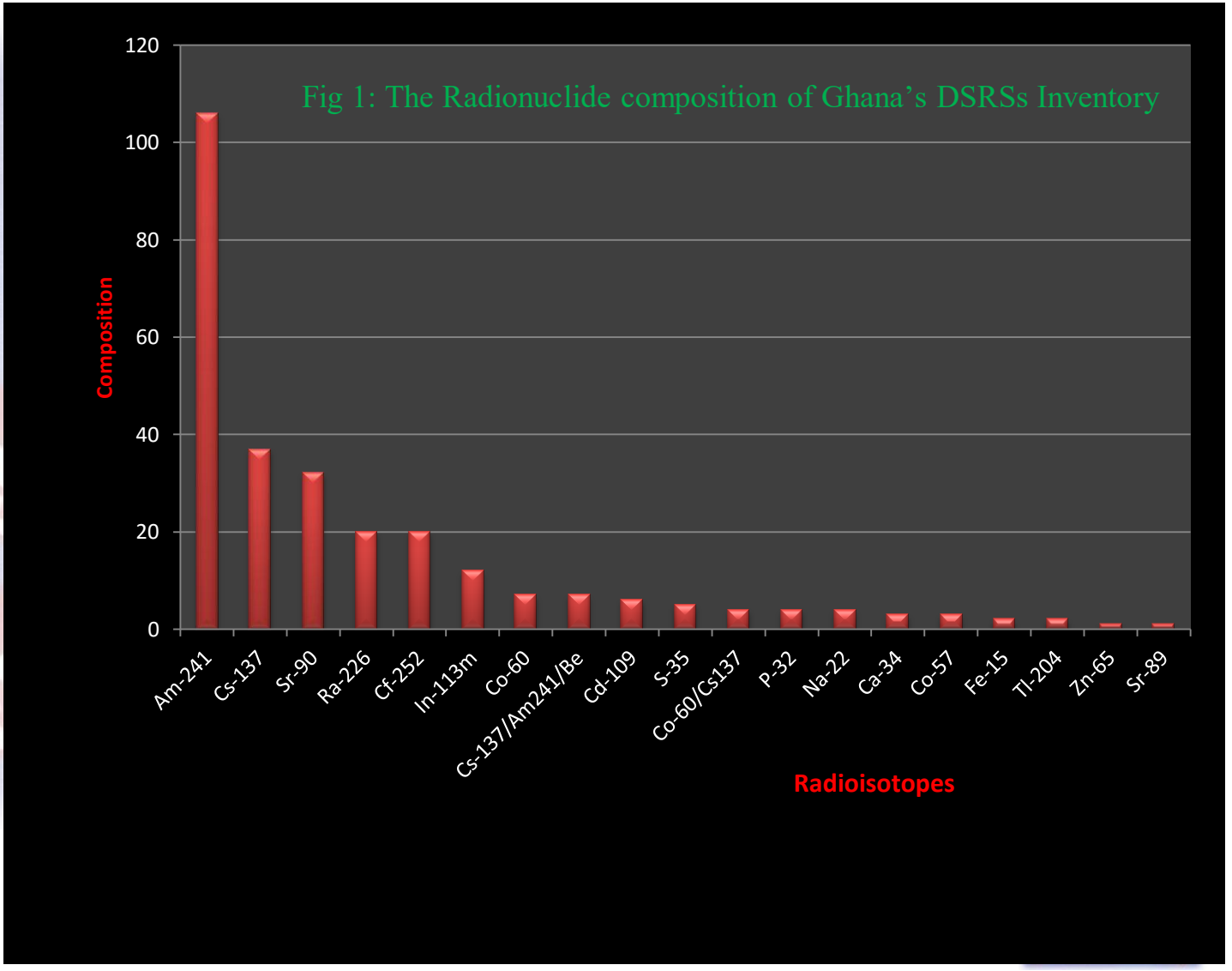
Ghana's radioactive waste inventory

- The NRMWC has a computerized database of all radioactive waste generated in Ghana; **Radioactive Waste Management Registry (RWMR)**

- This registry is compiled in close collaboration with the Radiation Protection Board, the licensing institution for these materials.

Ghana's radioactive waste inventory

Radionuclides	Number
Am-241	106
Cs-137	37
Sr-90	32
Ra-226	20
Cf-252	20
In-113m	12
Co-60	7
Cs-137/Am241/Be	7
Cd-109	6
S-35	5
Co-60/Cs137	4
P-32	4
Na-22	4
Ca-34	3
Co-57	3
Fe-15	2
Tl-204	2
Zn-65	1
Sr-89	1
Total	**276**



Ghana's radioactive waste inventory

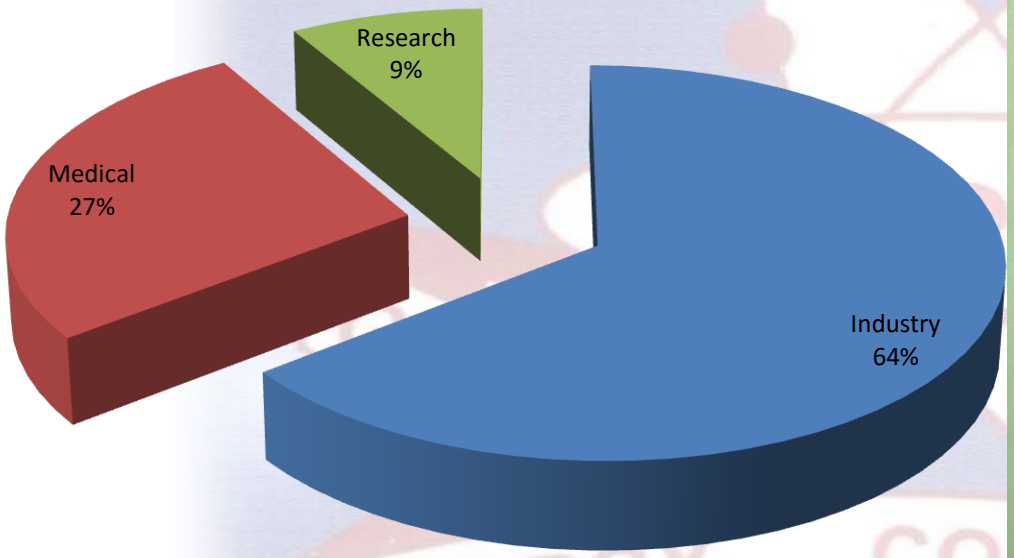


Fig 2a: The Contribution of various economic Sectors to Ghana's DSRSs inventory

Fig2b: Some Categories 1& 2 DSRS

Institutional framework for managing RW

- The National Radioactive Waste Management Centre (NRWMC), was established in July 1995 under the NNRI to among others

✓ Manage radioactive waste generated in Ghana.

✓ Establish facilities for management of radioactive waste

✓ Carry out R&D activities to develop safe radioactive waste management protocols.

❖ The RPB is responsible for the enforcement of appropriate waste management regulations and other relevant requirement.

Ghana's plan/policy for managing RW

- The **primary responsibility** for the safe management of RW rests with the **generator** until the responsibility has been legally transferred to the NRWMC.
- The RW generator is responsible for on-site temporary storage of the RW under the licensing permit of the regulator, RPB.
- The NRWMC is responsible for further management once the RW is in our custody.
- The **Polluter Pay Principle** is employed in Ghana in exception of **Orphan sources.**
- The RW generator applies to the NRWMC through the RPB if the RW is not covered by return to manufacturer policy.

Infrastructure and Resource Availability

- **Infrastructure**

Fig.3 Old Facility

Fig.4 Current Facility

The NRWMC now has a well secured radioactive waste storage facility.

Fig. 5 Physical Protection System

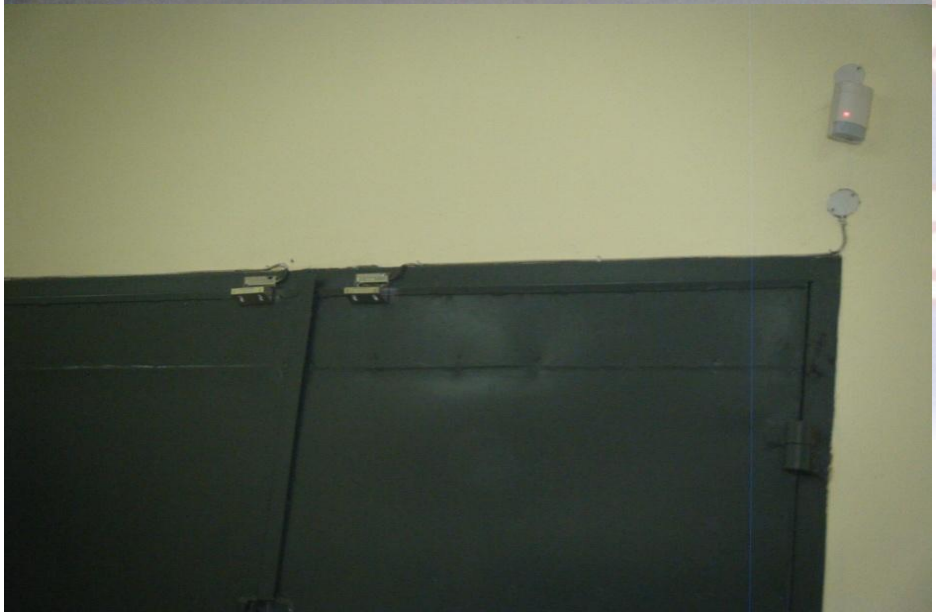


Fig.6 Radioactive Waste Storage Cages

Infrastructure and Resource Availability

- *Resource Availability*

❖ *Human Resource:* Nine (9) Scientific Officers and Two (2) Technologists

❖ *Equipment: IAEA Support*

i. **Source Characterization equipment**: Falcon and Atomtex

ii. **Radiation Monitoring equipment**: Radiagem, RadEye, Digital Dosimeters, Hand and Foot Monitor

iii. Trolleys, Tongs etc

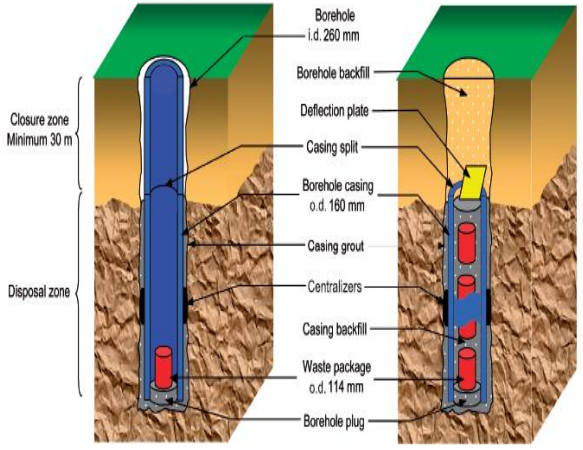
Management options for RW

Current:

Retrieval, transport, Characterization and interim storage

Future:

- Establish waste processing facility; Conditioning
- Disposal; Borehole Disposal Concept (BDC)



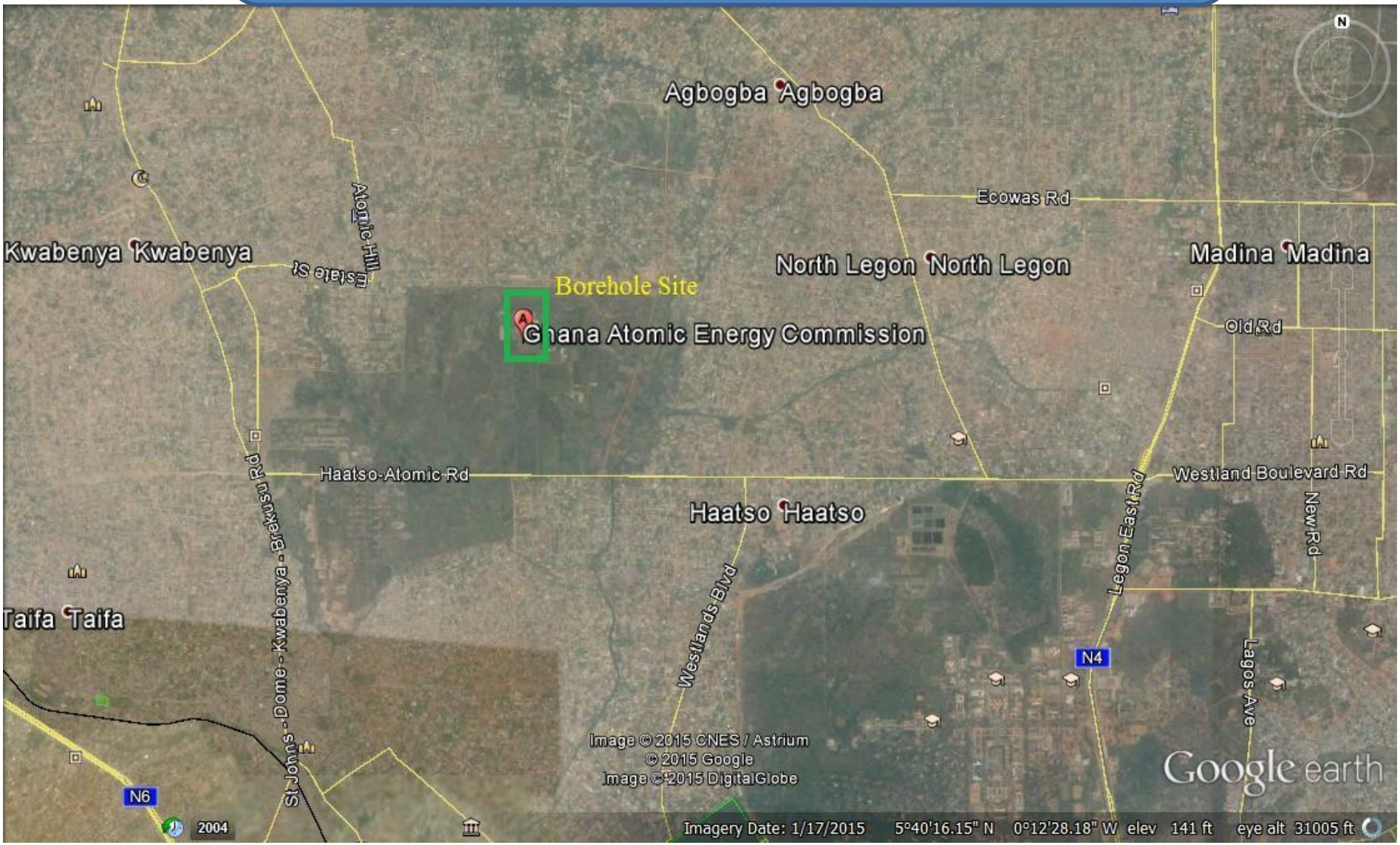
Disposal plan; The Borehole Disposal Concept

- Ghana is one of the first countries globally to have adopted the Borehole Disposal Concept (BDC) as the Cradle or End-of-Life management option for her RW.
- The feasibility study for BDC was conducted by **Necsa** in collaboration with the **IAEA**.
- BDC was chosen because:

i. Ghana has a relatively small RW inventory

ii. BDC is very economical, safe and requires little space with low anticipated footprint

Borehole Site



Site Characterization

Two exploratory boreholes (150m) each have been drilled for detailed site characterization





Site Characterization Cont'

Detailed site characterization: Geo-/Hydro-chemistry, Hydrogeology, Geology

Geo-/Hydro-chemical Data

- pH
- Chloride
- Sulphate
- Eh

Hydrogeological Data

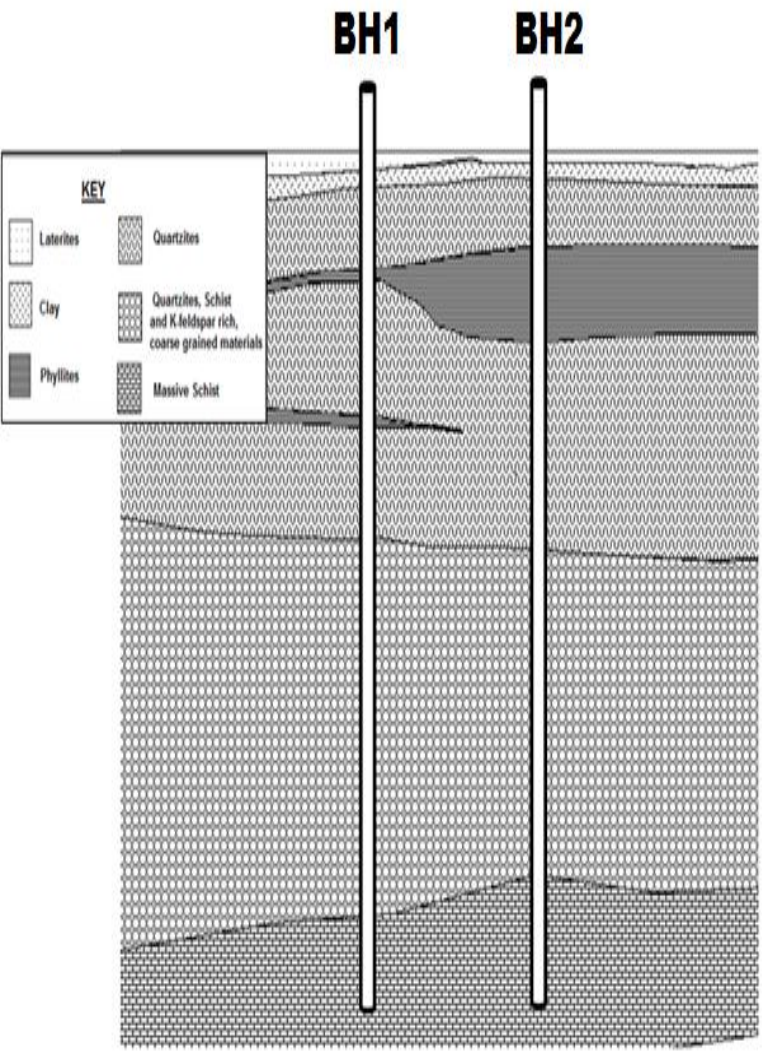
- hydraulic conductivity
- Transmissivity & Storativity
- hydraulic gradient
- porosity

Geology Information

- Rock type
- Rock strength
- Fractures

Site Characterization Cont'

Summary of the Geological Log



IDs	Laterite	Clay	Quartzite	Phyllite	Mixed materials	Schist	Fracture	Water Strike
BH1	0-4m	4-6m	6-12m 13-37m 38-50m	12-13m 37-38m	50-122m	122-150m	33-36m 47-55m 89-108m 112-115m	50-51m 94-95m 99-102m
BH2	0-2m	2-4m	4-9m 19-52m	9-19m	52-110m	110-150m	31-41m 47-74m 99-105m	62-63m 104-107m

Safety Assessment

Concerns, problems and challenges in managing RW

- The bane of Ghana's snail pace in implementing the BDC according to the initial schedule is mainly due to the lack of funds or delayed in releasing funds.
- Culminated in inability to procure relevant equipment for the various aspects of the project.
- Unstable electricity supply

SUMMARY

➢Ghana has the fundamental

- Legislative and Regulatory background and framework,
- National Policy and Strategy,
- Infrastructure, Human Resource and
- Management System upon which the **BDC** can thrive provided the necessary Financial resource is provided.
- Recent events, however, point to a stronger international support for the smooth execution of the project particularly from the IAEA.

THANKS FOR YOUR ATTENTION!!!