IMPLEMENTATION OF THE BOREHOLE DISPOSAL FACILITY IN GHANA-ISSUES AND CHALLENGES

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Introduction

- Ghana Atomic Energy Commission (GAEC) was established by an Act of Parliament (Act 204) in 1963 which has been replaced by Act 588 in 2000.

- The main functions of the Commission include the

✓ promotion,

✓ development and

✓ peaceful application of nuclear techniques in Ghana.

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Regulatory framework

- The Radiation Protection Board (RPB) was established in 1993 by the legislative instrument LI 1559 as the National Regulatory Authority in Ghana.

- It has the mandate to

✓ license,

✓ register,

✓ authorize and

✓ inspect radiation sources and facilities

- The RPB also enforces codes of practice for the purposes of radiation safety in Ghana.

Radioactive Waste Management

- The National Radioactive Waste Management Centre (NRWMC), was established in July 1995.

- The functions of the NRWMC include:

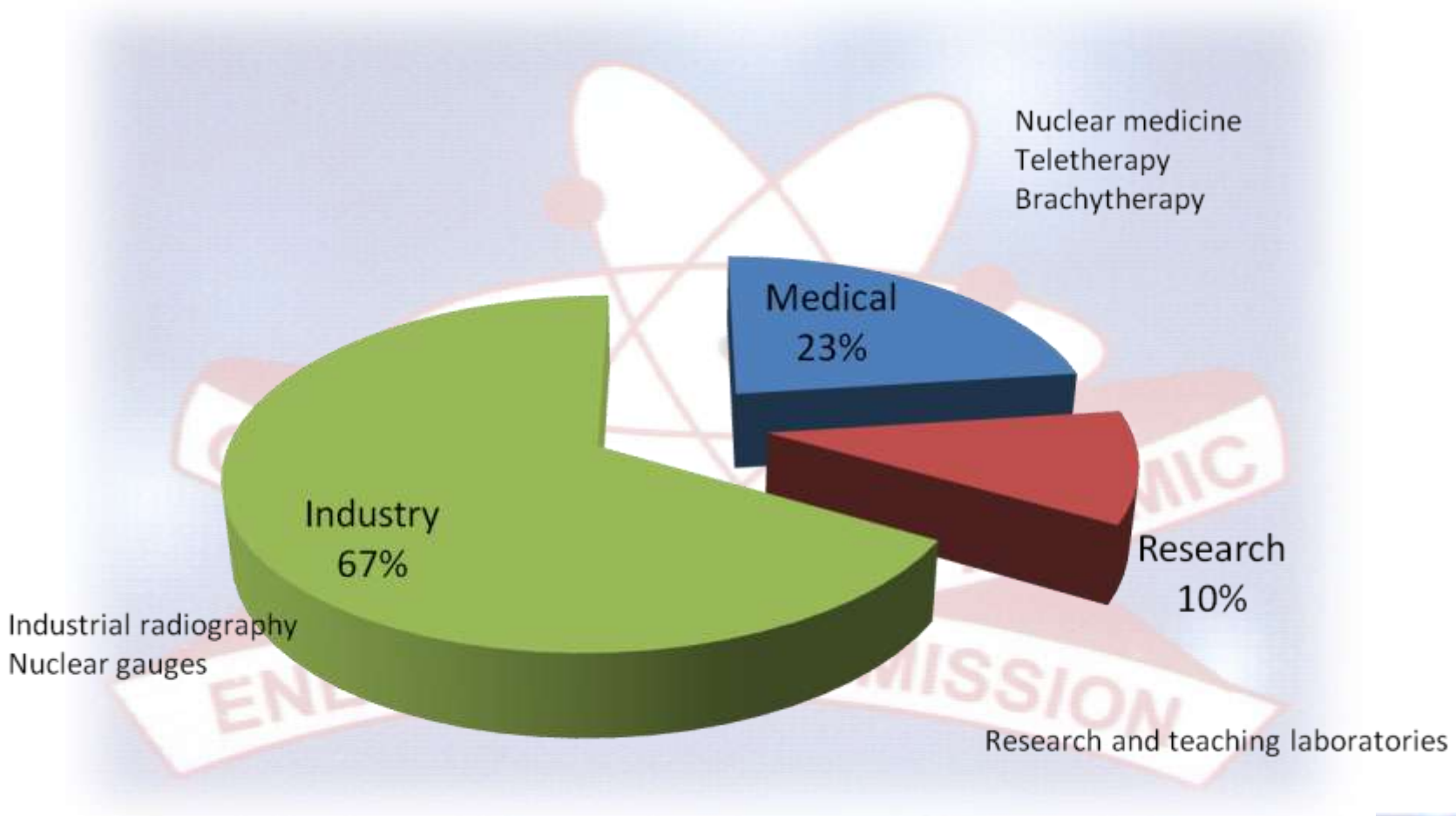
✓ Management of radioactive waste generated in Ghana

✓ Establishment of facilities for management of radioactive waste

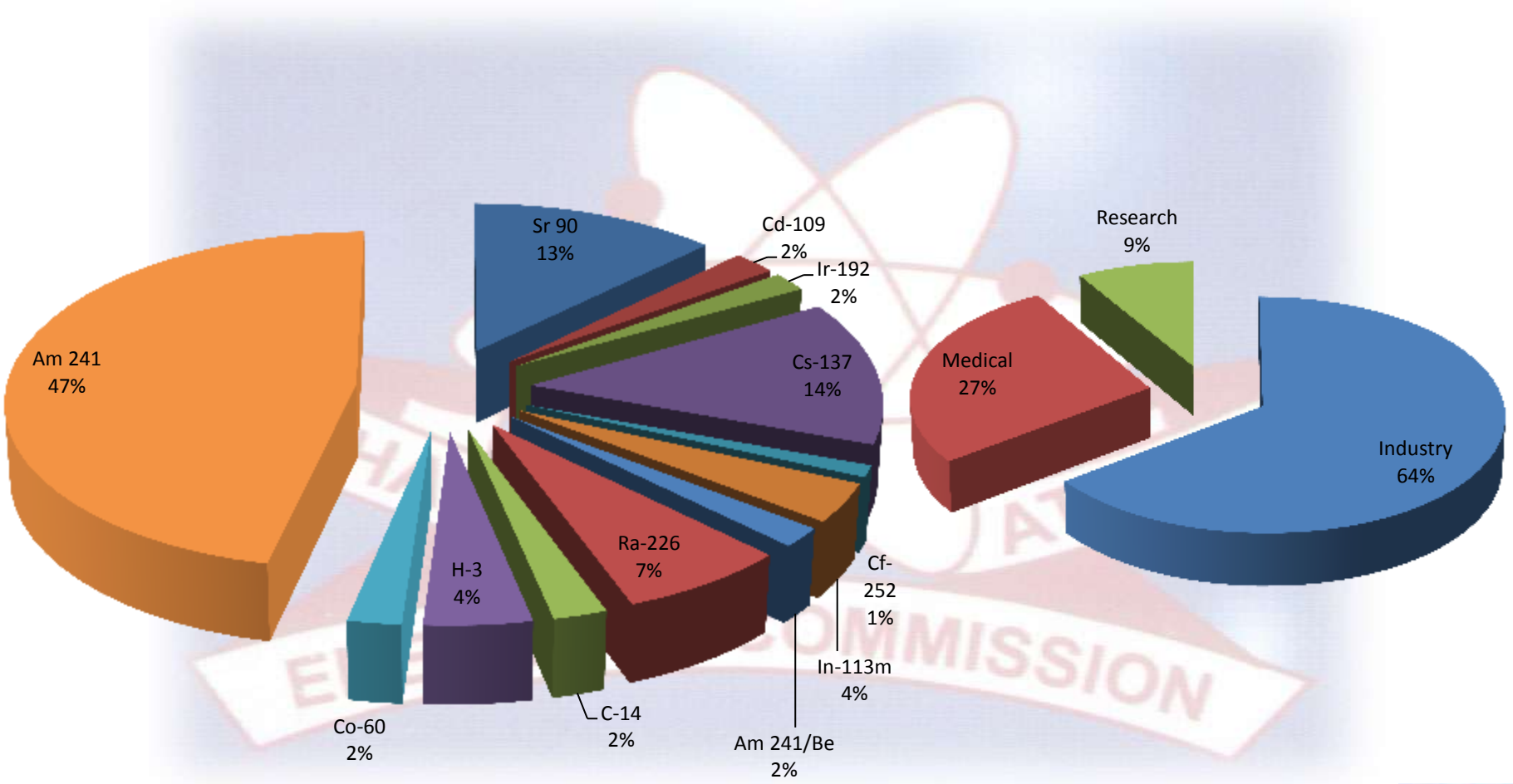
✓ Research activities to develop safe radioactive waste management protocols.

- The National Radioactive Waste Management Regulation was promulgated in 2009

Sealed Radioactive Sources in Ghana



Radioactive Waste Inventory

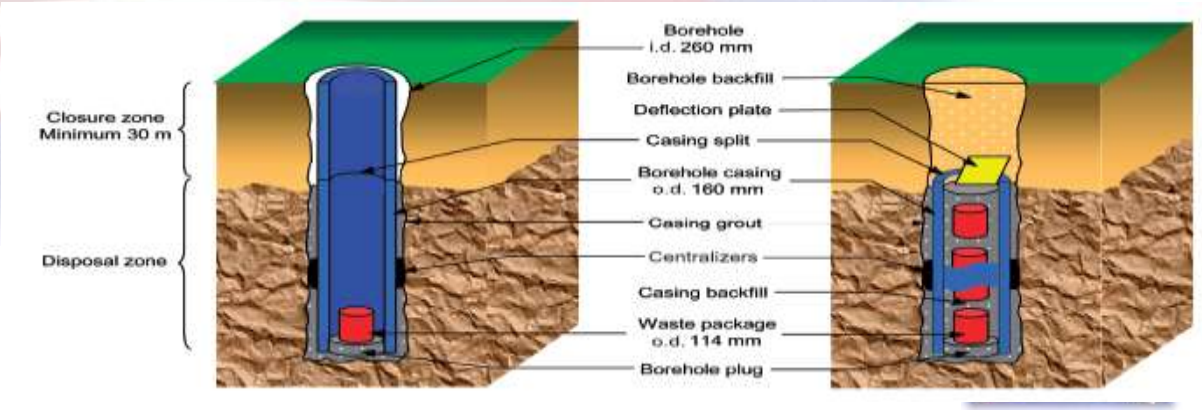


Radioactive Waste Management Practice

- The radioactive waste management system practiced in Ghana is storage.
- Most the sources in storage are legacy wastes
- The storage capacity of the storage facility is inadequate.
- The storage facility lacks the necessary physical protection systems that will secure the stored waste materials from theft, etc.
- Storage is therefore considered an unsustainable management option due to the long half life of some of the radionuclides and the threat to nuclear security in the country.

Borehole Disposal Concept (BDC)

- In 2005 the Ghana through GAEC expressed the willingness to exploit the BDC for disposal its disused sealed sources
- A group of scientists from
  - National Nuclear Research Institute (NNRI) of GAEC,
  - Ghana Geological Survey Department,
  - Ghana Hydrologic Services and the
  - Water Research Institute of the CSRI
- to study the BDC and characterize a site for its implementation in Ghana.



Pre-Project Mission

In May 2006 there was an IAEA expert mission to Ghana to

- advise the Ghanaian authorities on the applicability of the Borehole Disposal Concept,
- the possible implementation of the Borehole Disposal facility and
- the suitability of the candidate disposal site

Results of the Pre Project Mission

- The roles of the Regulator and Implementer are well defined and separated.
- The national inventory of radioactive waste requires further development.
- The considered site seems to have suitable geochemistry and hydrogeology, acceptable seismicity, but complex geology; (Recommended detailed geological investigation).
- Ghana has expertise and some equipment that would be useful in characterising a site
- Potential contractors exist for construction of the facility.
- Ghana would need further training and IAEA assistance to develop the facility.

Geological Map of Accra (Kwabenya)

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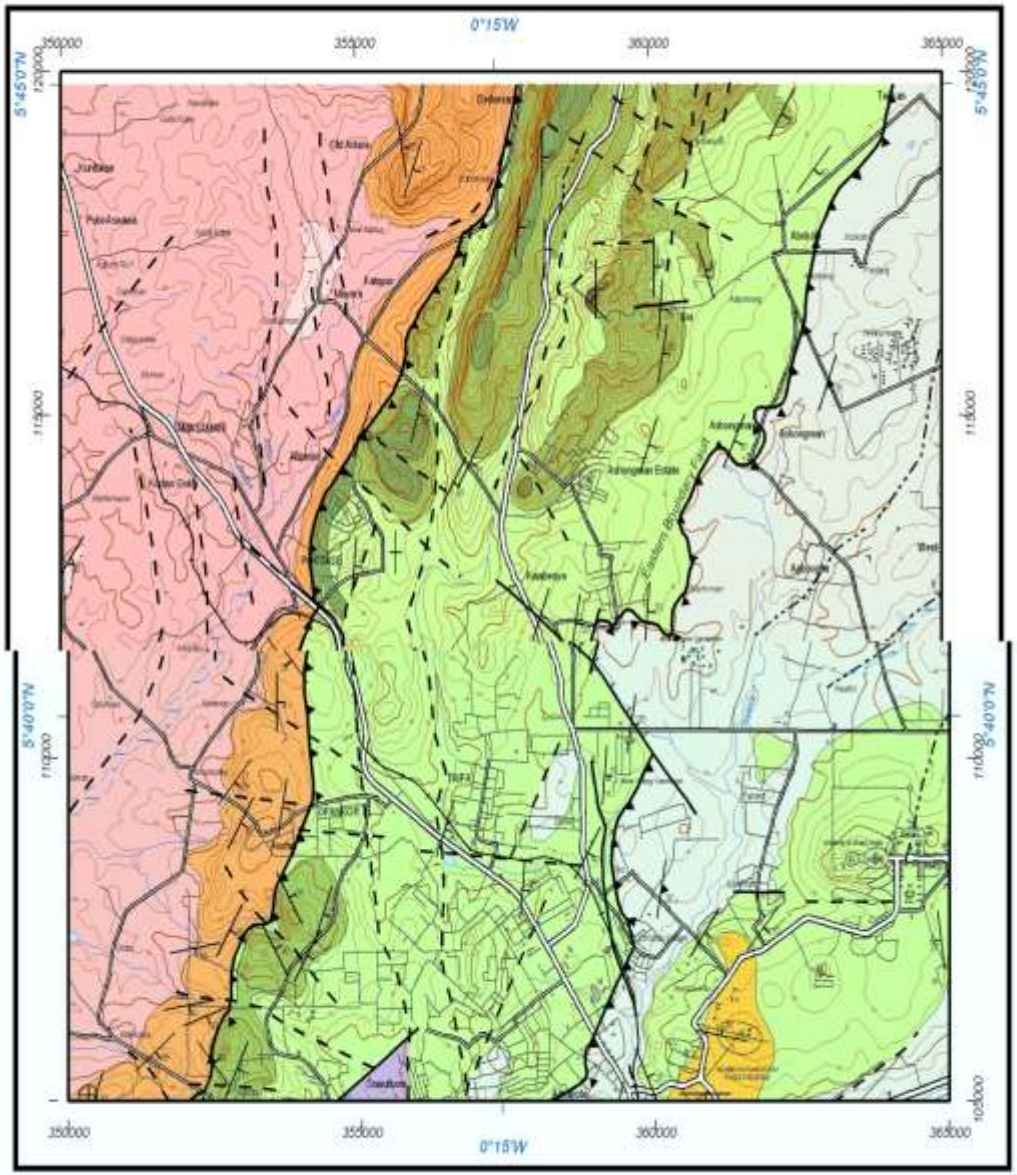


Geological Bodies

Unconsolidated and poorly consolidated sediments and soils (Quaternary or tertiary age)

- Red, continental deposits
- Marine, fluvial or lacustrine sediments
- Consolidated beach sediments (beach rock)
- Unconsolidated or slightly consolidated cobble colluvium (piedmont-type conglomerate)

Accraian Series (Devonian age)

- Upper Sandstone-Shale Formation
- Middle Shale Formation
- Lower Sandstone Formation

Voltaian System (Lower Paelozioc age)

- Quartzose and impure sandstones

Togo Series (Upper Precambrian age)

- Phyllite Unit: Mainly phyllite and phyllonite, often talcy; with interlayers of thin quartzitic bands, chert, or quartz-schist
- Quartz-Schist Unit: Mainly sericitic quartz schist; with interlayers of quartzitic bands, phyllite or chlorite schist or phyllite
- Quartzite Unit: Mainly quartzite which sometimes possesses aspects of banded chert; with interlayers of quartz-schist or phyllite

Dahomeyan System (metamorphic basement rocks of Middle- Late Precambrian age)

- Quartz schist, often fine grained and equigranular
- Orthogneiss and augen gneiss of dioritic to granodioritic composition
- Metamicrogabbro and amphibolite, forming sills and dykes
- Calcareous quartz schist
- Schistose marble

Dahomeyan System (metamorphic basement rocks of Middle Precambrian age)

- Foliated, massive or banded biotitic amphibolite

Granitic intrusions (Middle Precambrian age)

- Fresh, weathering-resistant migmatitic biotite-hornblende granitoid
- Deeply weathered granitoid-pegmatite complex
- Porphyritic granite
- conners

Geological symbols

- Strike and dip of bedding (including mylonitic foliation in Togo Series)
- Vertical bedding (including mylonitic foliation in Togo Series)
- Horizontal bedding
- Strike and dip of foliation in granitoids
- Vertical foliation in granitoids
- Strike and dip of schistosity
- Vertical schistosity
- Thrust and low-angle reverse fault; observed and reasonably well stablished
- Normal fault; observed and reasonably well established; hatchure on down-thrown block
- Observed and reasonably well established fault; unspecified
- Inferred fault
- Concealed fault
- Lineament in aerial photos and digital elevation model
- Observed or reasonably well established geological boundary
- Approximate geological boundary

Geophysical Investigation

- In April 2008 the Ghana Geological Survey Department was contracted to carry out geophysical and geological investigation

- They first carried out the geophysical investigation (Seismic Refraction and electrical resistivity studies) of the area

- The results of their investigation indicated that

✓ The bedrock has high compressional and shear velocities

✓ True resistivity of bedrock suggested that the bedrock is probably gneiss

✓ Two weak lines F1 and F2 which could be faults/geological contacts were mapped

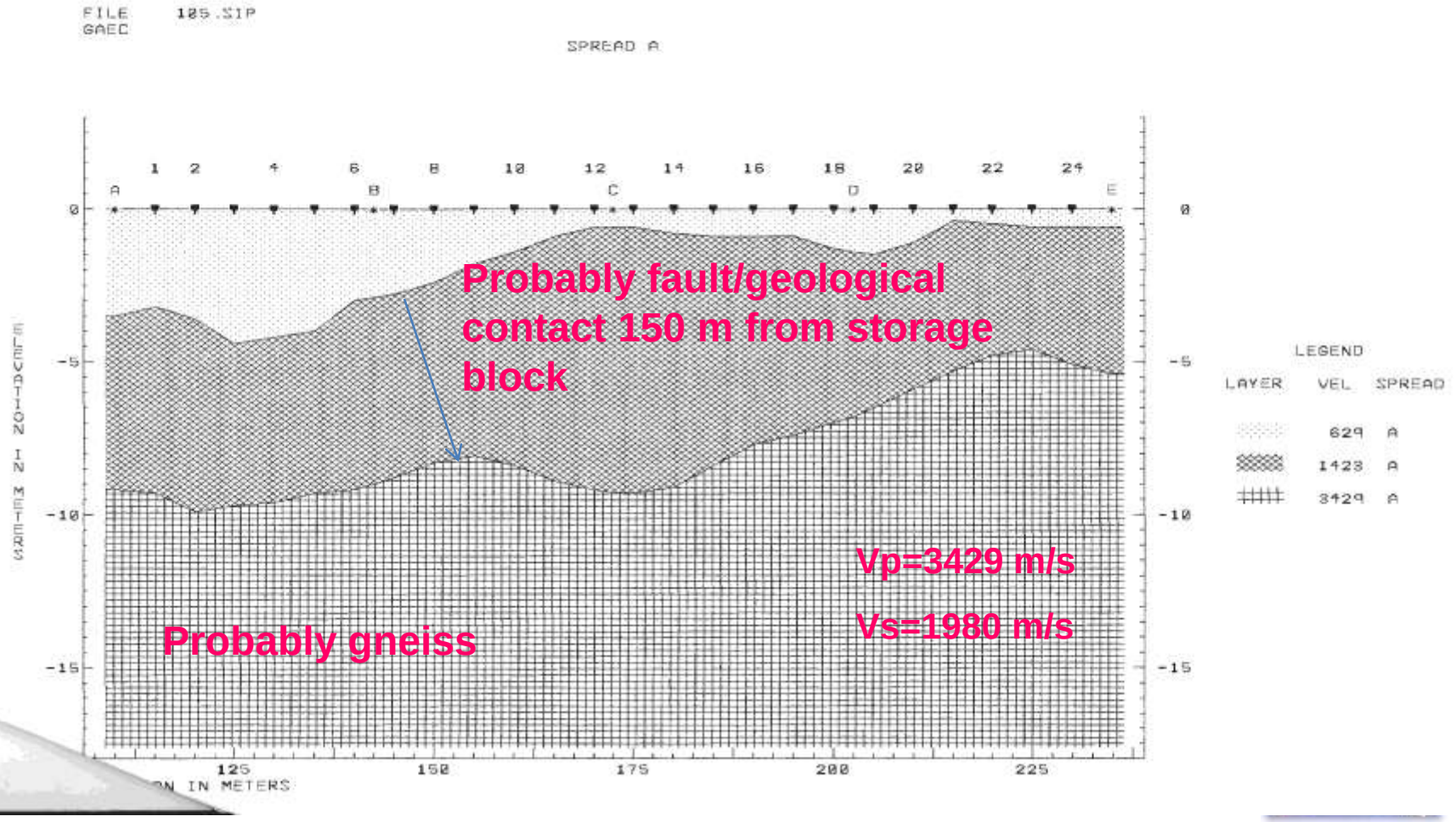
Recommendation

- They recommended two drilling points for further geological investigation.

- The two fracture lines must be avoided as they can cause leakages of the radioactive materials and pollute potable ground water.

Poisson Ratio=0.25

For bedrock suggesting gneiss



Bedrock-Dahomeyan quarztite

Review of Geophysical Investigation

- In September 2008, an IAEA expert mission to Ghana was undertaken
- to review the geophysical investigations carried out.
- The Expert recommended

➢ drilling of two core boreholes at the suggested points

➢ The boreholes must be at least 100m deep

➢ Used to characterize the disposal zone which will lie at a depth of between 30m and 100m.

Technical Cooperation Project: GHA3003

- A Technical Cooperation Project: Implementation of BOSS in Ghana(GHA 3003)is current on going.
- To characterize the selected site for the Borehole Disposal facility
- Duration: 2009 – 2011
- IAEA Input

✓ Expert missions

✓ Equipment – characterization of sources

✓ Training –fellowship and Scientific Visits

Safety Assessment (SA) Mission

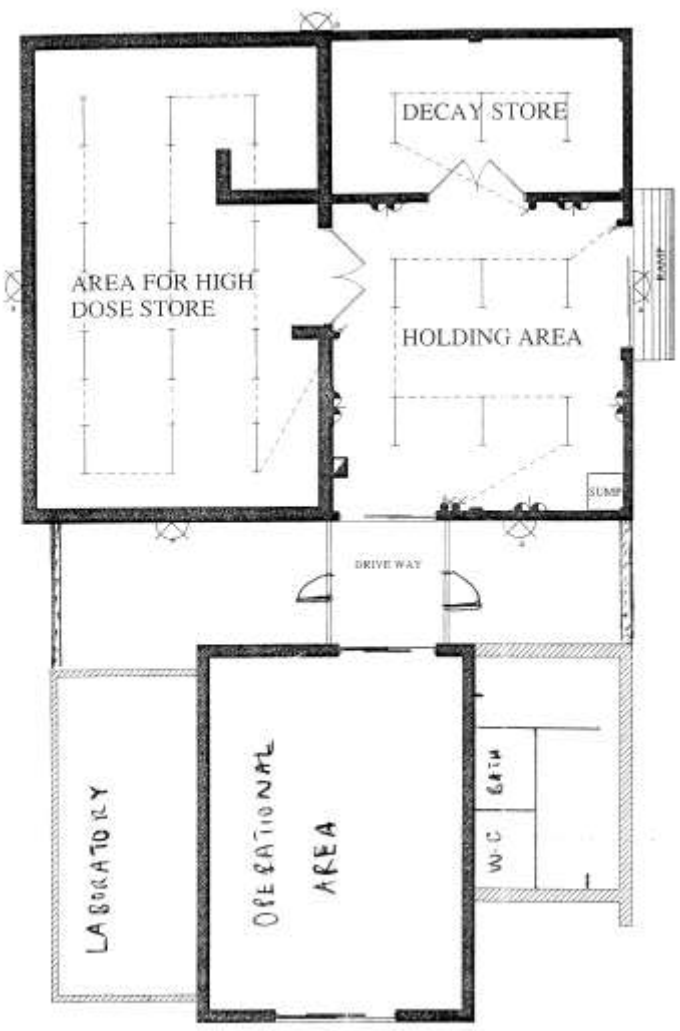
- In December 2009, there was an Expert mission in Accra
- The mission provided
- Advice on the use of SA to inform decisions on the Borehole disposal facility
- Training on the use of the generic SA of the BDC
- Advice on what data must be collected from the site during investigation and how it must be used
- The outcome of the Mission
- A Safety Assessment team has been formed to

✓ Study the generic BDC SA document

✓ Carry out the SA for the concept in Ghana

Conclusion-Challenges

- Contractors not interested in drilling only two core boreholes
- High cost in carrying out core drilling
- Radioactive waste management fund ???
- Characterization of the disused sources is tied up with the completion of Waste management facility



GROUND FLOOR PLAN


THANK YOU