

Ageing Management Activities of Ghana Research Reactor-1

HENRY CECIL ODOI

IAEA TECHNICAL MEETING ON RESEARCH REACTOR
AGEING MANAGEMENT, REFURBISHMENT AND
MODERNIZATION



Ageing Management

- Ageing management is the process of ‘determining’ and ‘applying counter measures to’ ageing effects.

- These counter measures can be:
 - ▶ Protection
 - ▶ Repair
 - ▶ Replacement
 - ▶ Refurbishment



Objective and Scope

□ Objective

- ▶ Activities/Documentation of ageing management programme for GHARR-1 SSCs

□ Scope

Evaluate and characterize SSCs according to:

- ▶ Physical Ageing
- ▶ Non Physical Ageing / Obsolescence



Criteria for classification of SSCs according to Safety

Based on SSG-10:

A – A change in physical properties (swelling, chemical deposition, changes in material, strength, ductility, resistivity etc.)

B – Irradiation and thermal embrittlement

C – Corrosion, including corrosion erosion and corrosion assisted cracking

D – Wear (e.g. fretting) and wear assisted cracking (e.g. fretting fatigue)



Physical Ageing

Pool and Reactor materials	Ageing mechanism
Core support structure	B, C, D
Grid plate	B, C, D
Embedded piping	A, B, C, D
Pool lining	B, C
Reflector	B, C
Control Rod and Mechanism	B, C, D
Fuel Assemblies	A, B, C, D



Reactivity control system

Control rod drive motors

Control rod drive (gear system)

Control rod magnets

Ageing mechanism

D

D

B, C, D

Cooling system

Vessel

Piping

Pool

Ageing mechanism

A, B, C,

A, C, D

A, B, C



Confinement	Ageing mechanism
Vessel	A, B, C
Ventilation	C, D
Stack	A

I & C	Ageing mechanism
Radiation monitors	B, C
Protection system (control logic)	C, D
Shutdown system	C, D
Cabling	B, C



Experimental Facilities	Ageing mechanism
Irradiation tubes	A, B, C, D
Transfer port	A, C, D

Auxiliary systems	Ageing mechanism
*Emergency diesel generators / UPS	C
Fire system	C
Crane	A, C, D
Deionized system	A, B, C, D



Non-physical Ageing

Documentation	Ageing mechanism
SAR	Change of regulation, Obsolescence of documentation
OLC	Obsolescence of documentation
Management system	Change of regulation, Obsolescence of documentation
Licensing	Change of regulation
Operating procedures	Obsolescence of documentation
Other	Mitigation
Staff	Succession planning
Technology	New trends, modification



Physical Ageing Activities 1

Activity	DATE
Snapped of the control rod wire (First major problem)	March, 1996
Breaking down of High Voltage Power Supply System of the gamma monitor located on the control console. New one was designed to replace the old one	May, 1997
Repair of control rod drive mechanism -	February, 2001
Addition of Be shim plates (3mm thickness added)	February, 2002
. Reactivity adjustment (Removal of one reactivity regulator) -	July, 2005



Physical Ageing Activities 2

Activity	DATE
Maintenance and repair of control rod drive mechanism	Nov., 2007
Addition of Be shim plates (3mm thickness added)	April, 2009
Installation of a new control rod drive mechanism	August, 2009
Installation of new HPGe detector (model:6MX40P4)	July, 2010
Installation of WINSPAN (NAA)	January, 2011

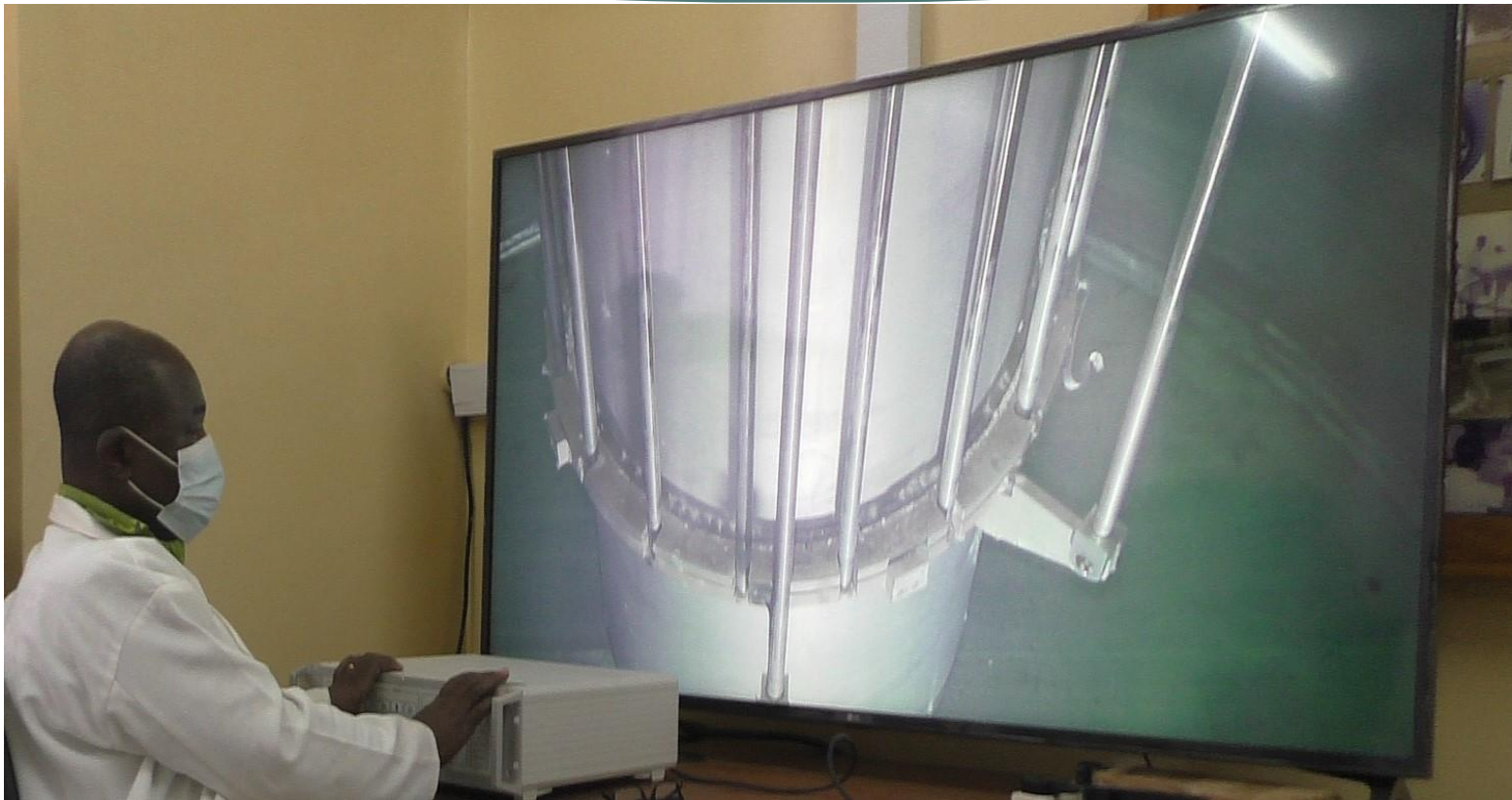


Physical Ageing Activities 3

Activity	DATE
Addition of Be shim plate (3 mm thickness added)	January, 2011
Removal of large sample irradiation tube and shim tray for HEU with three 3 mm Be shim plates	August, 2016
HEU core removal	August, 2016
LEU core loading	July, 2017
Replacement of transfer tubes -	August, 2019



Visual Inspection using Under Water Camera



Conclusion

- ▶ The cumulative effect of physical ageing and obsolescence may result in short lifespan of the RR as well as affecting the safety performance
- ▶ GHARR-1 has been operated nearly over two decades. Ageing Management programme keeps the facility in good shape
- ▶ GHARR-1 is expected to run for the next forty years without fueling, which make AM activities very important

