Transfer cask for interim transfer of MNSR core and core loading and off-loading operations

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Introduction

In February 2011 with support from IAEA an international working group has been established in order to coordinate the program for conversion of the Chinese origin miniature neutron source reactors (MNSRs) to LEU and the return of the HEU core to the People's Republic of China.

The pilot project under this program will be the shipment of the HEU fuel from the GHARR-1 reactor owned by the National Nuclear Research Institute (NNRI) of Ghana Atomic Energy Commission (GAEC).

IAEA Consultancy Meeting

At the IAEA Consultancy Meeting held in February 2015 Sosny R&D Company presented a pre-conceptual design for unloading the MNSR core from the GHARR-1 reactor and its loading into the modified SKODA VPVR/M cask.

The pre-conceptual design was based on a set of equipment that includes a special transfer cask.

Procedure Areas

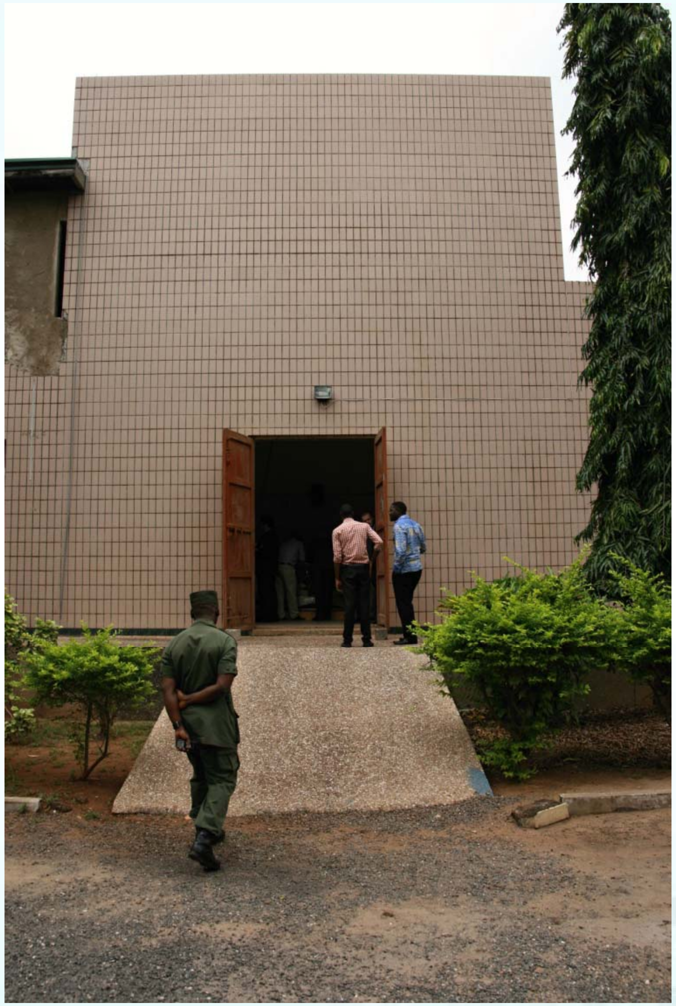
The pre-conceptual design describes creating two procedure areas: a GHARR-1 reactor core unloading area and a modified SKODA VPVR/M (SKODA MNSR) cask core loading area.

The GHARR-1 reactor core unloading area will be located in the reactor hall of the facility and is purposed for direct loading of the MNSR core into the transfer cask, for mounting the transfer cask on top of the transport vehicle mounting frame to be followed by its transportation to the SKODA MNSR cask core loading area.

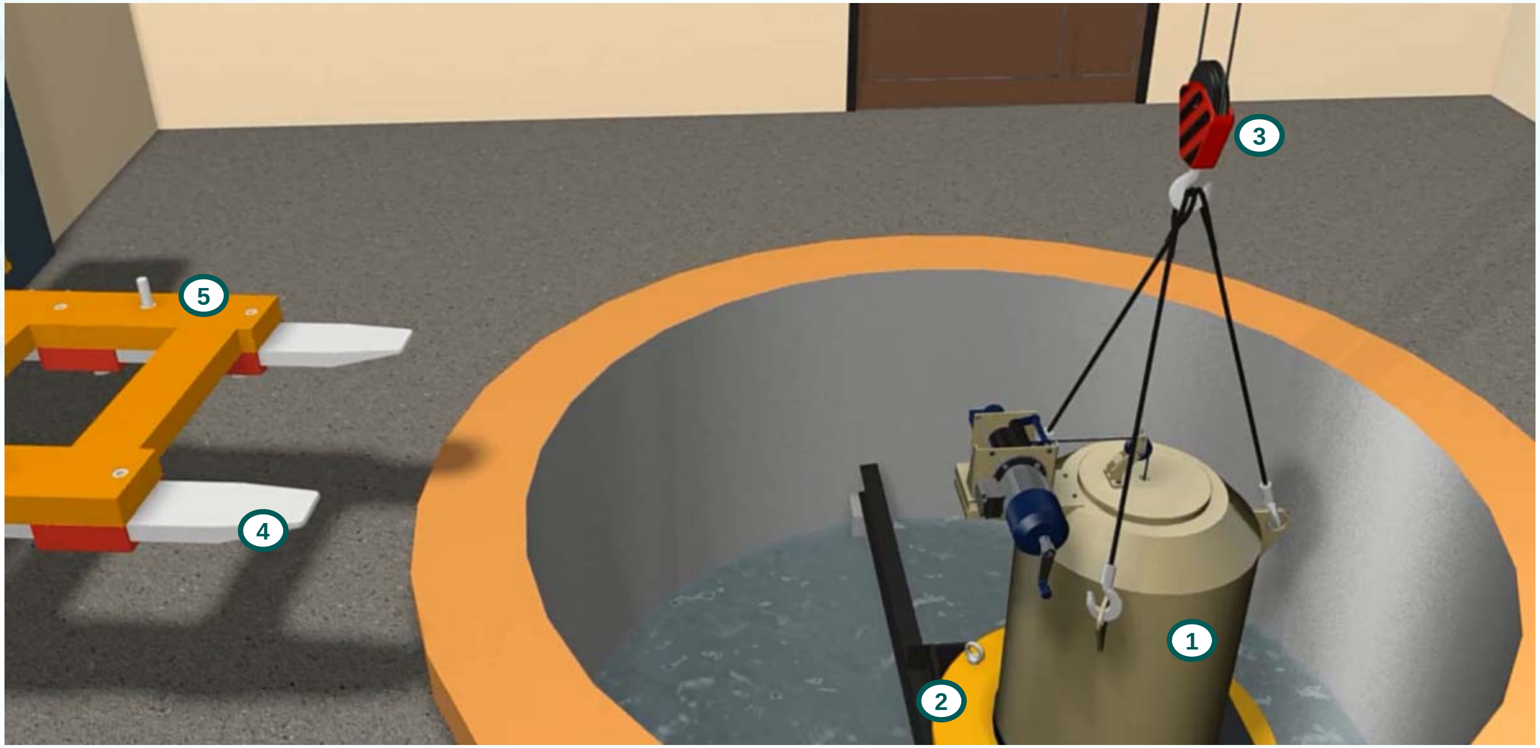
Procedure areas

The SKODA MNSR cask core loading area will be located at a specially equipped concrete platform immediately outside of the reactor building on the GHARR-1 facility site.

The area will be used for SKODA MNSR cask preparation, for installing the transfer cask onto the SKODA MNSR cask and for unloading the core into the SKODA MNSR cask basket.



Reactor core unloading area



Equipment to be used in the reactor core unloading area:

1. Transfer cask
2. Frame to arrange the transfer cask above the pool
3. Reactor hall crane
4. Transport vehicle
5. Transport vehicle mounting frame

SKODA MNSR cask core loading area

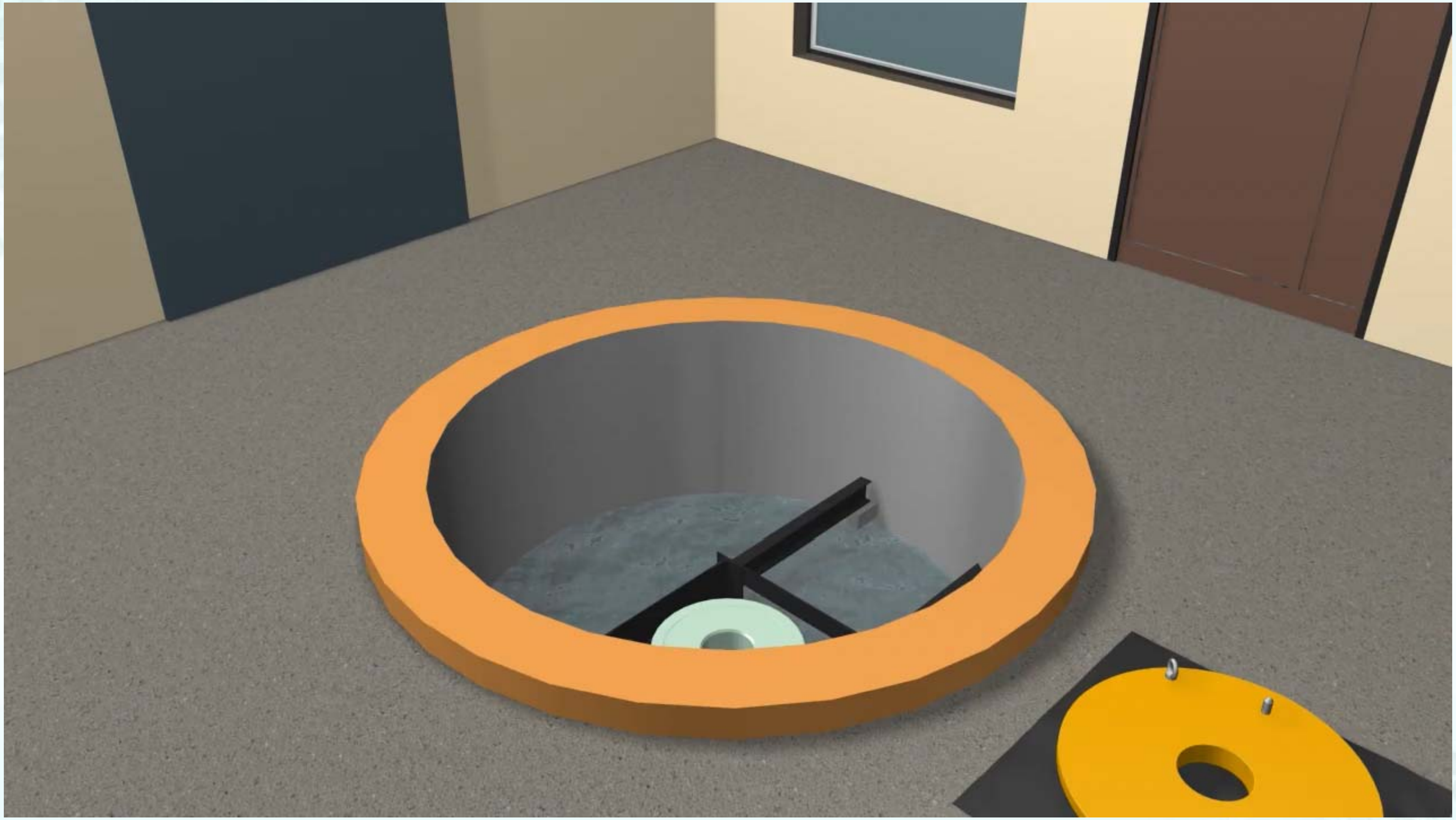
Equipment to be used in the SKODA MNSR cask core loading area:

1. SKODA MNSR cask service frame
2. SKODA MNSR cask upper internal lid
3. Adaptor ring
4. Adaptor
5. Mobile crane, 2 pcs.
6. Transport vehicle

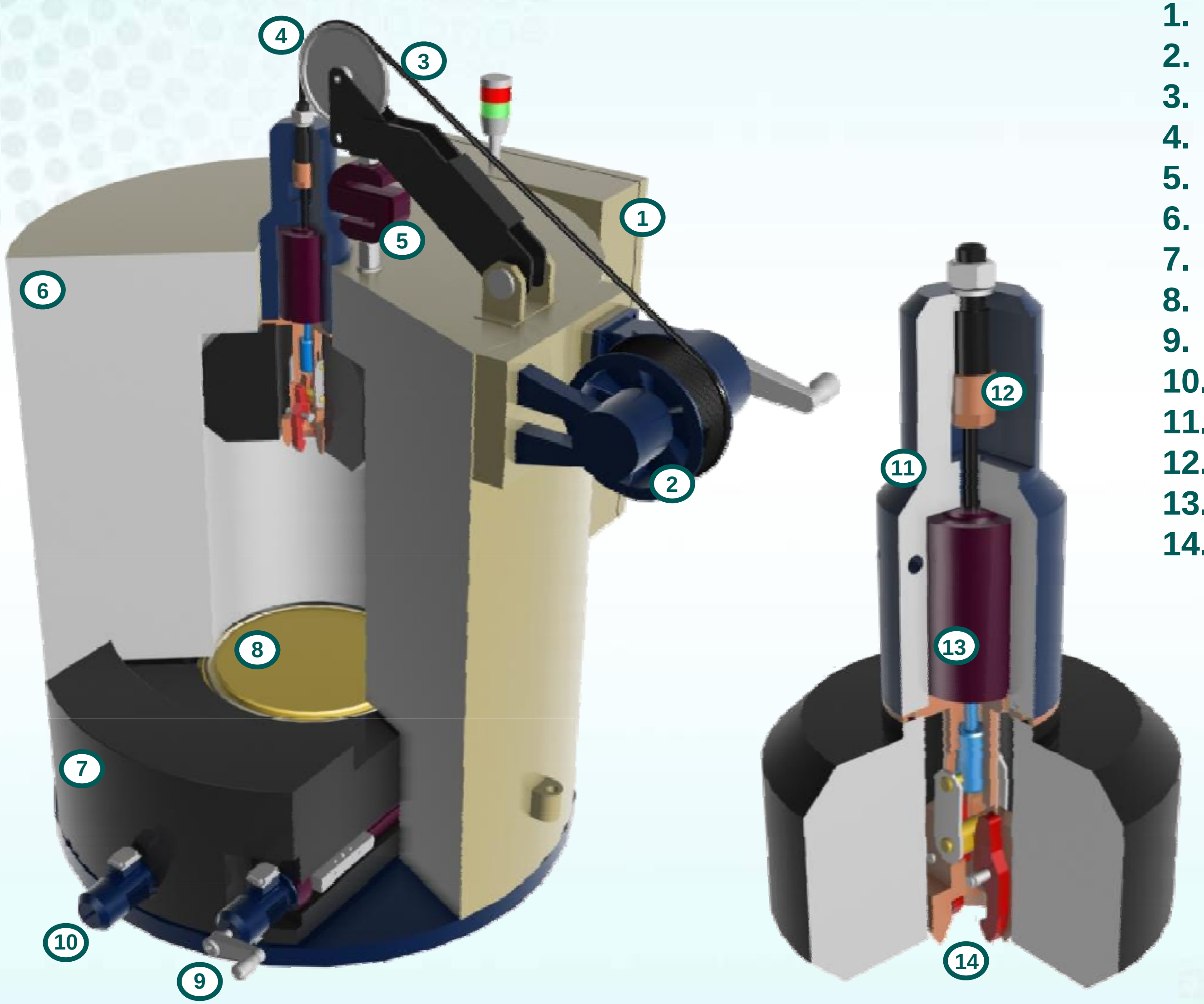
Transfer cask transportation from the reactor unloading area to the cask loading area

The transfer cask transportation may be performed by means of various transport vehicles. The transport vehicle mounting frame will be developed for the specific transport vehicle selected.

Procedure animation



General view of the transfer cask



1. Control cabinet
2. Electric winch
3. Load-bearing wire
4. Guide roller
5. Strain sensor
6. Cask body
7. Protective slide valve
8. Slide valve plug
9. Slide valve electric drive
10. Plug electric drive
11. Grapple housing
12. Electrical feedthrough
13. Electromagnetic drive
14. Grapple jaws

Transfer cask design features

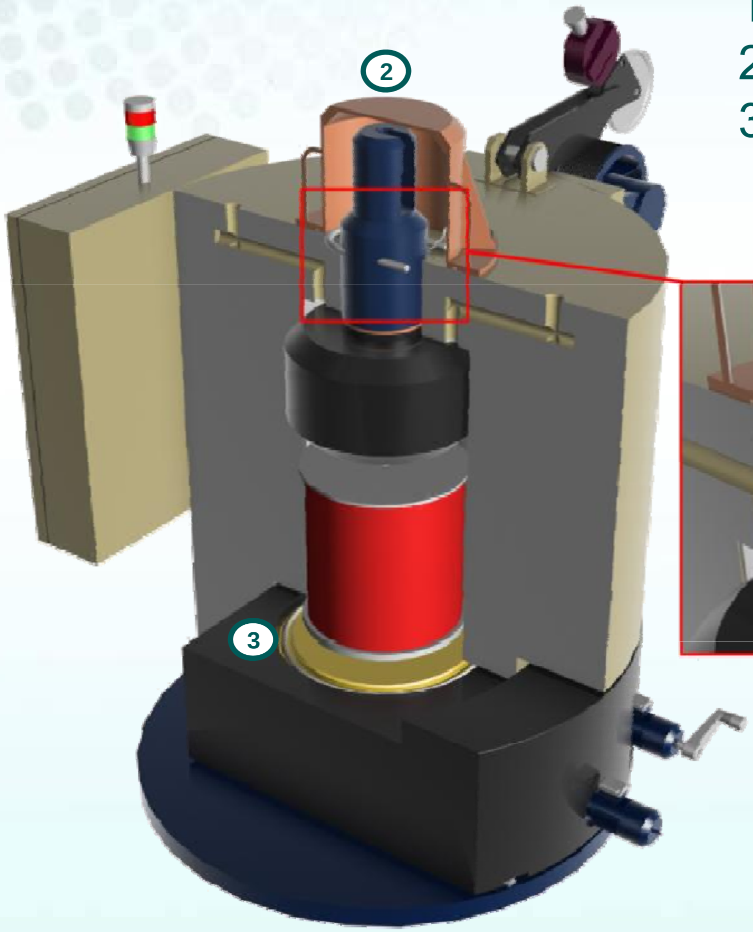
To provide protection from human error while handling the core the transfer cask will be equipped with: a sound and light alarm, a load-bearing wire strain sensor and the slide valve drive, plug drive and winch drive locks.

The winch, the slide valve and the plug drives will be equipped with manual drives used in case of emergency power loss.

The upper part of the transfer cask will have channels for attaching a hot air system for purging while the cask is above the pool and the core has been loaded into the transfer cask.

Temporary interim storage

The transfer cask is designed to allow temporary interim storage of the core. To facilitate this the cask is equipped with:

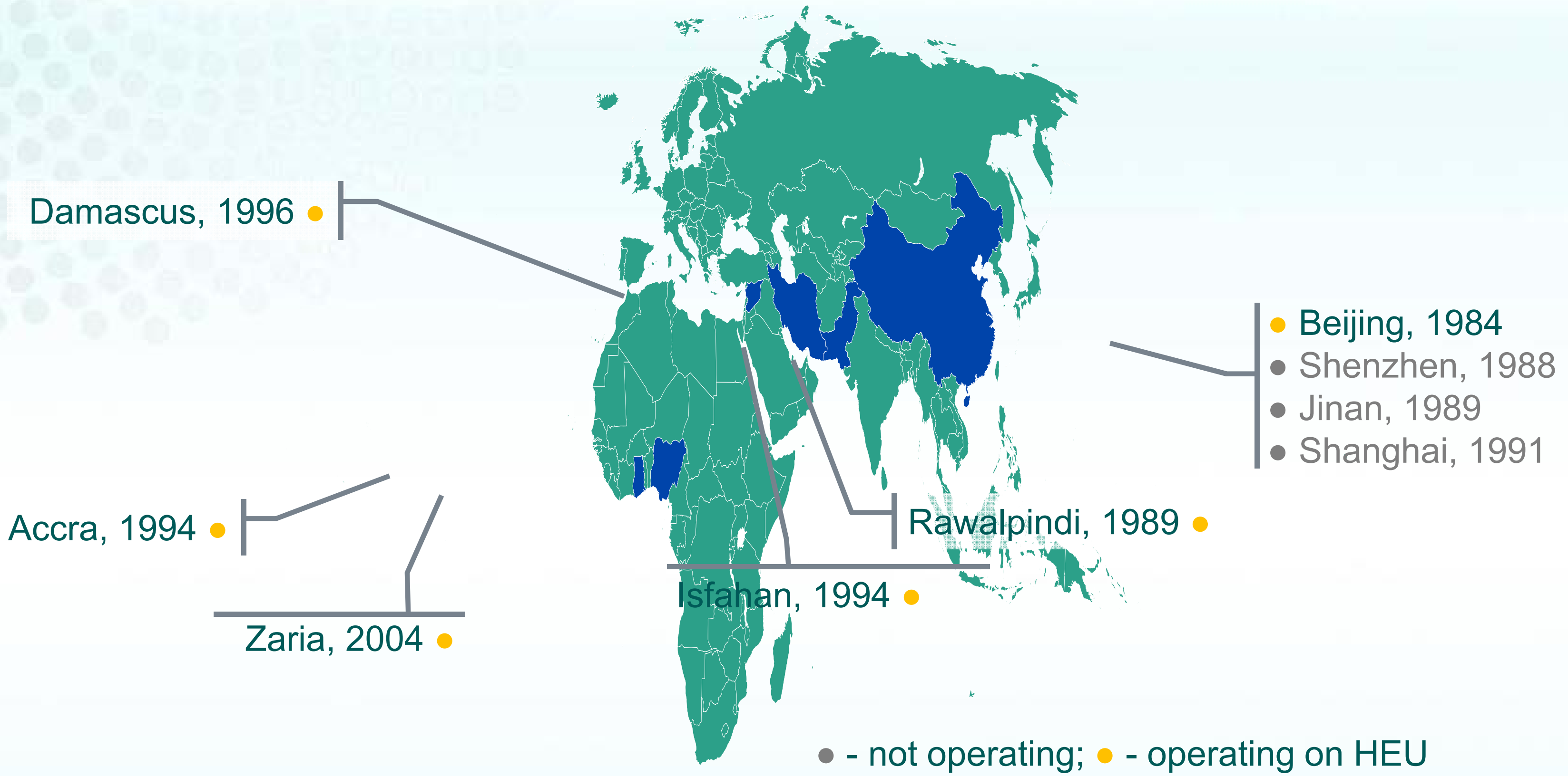


1. A core grapple lock cramp
2. A core grapple upper lid
3. Leak-tight rubber gaskets

In order to place the core into temporary storage the core is placed on top of the plug, the empty grapple is raised into its top position and is secured with a lock cramp, the load-bearing wire is disengaged from the grapple and the guide roller is being folded toward the winch.

Afterwards the core grapple lid is installed and the transfer cask internal volume is tightly sealed with a rubber gasket.

Procedure and equipment versatility



The procedures and equipment to be developed are potentially adaptable to their reuse at MNSR reactors in other facilities

Thank you for your attention!

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