

# Conversion of Miniature Neutron Source Reactors from High Enriched Uranium to Low Enriched Uranium

International work to convert or decommission highly enriched uranium (HEU) research and test reactors to low enriched uranium (LEU) fuel has taken place since 1978. The decades-long effort is achieved by a multilateral group of stakeholders with the objective of reducing and eventually eliminating the civilian use of HEU.

The Reduced Enrichment for Research and Test Reactors (RERTR) Program currently operated by DOE/NNSA Material Management and Minimization (M3) Conversion Program, exists to address this objective. Additionally, the Miniature Neutron Source Reactor (MNSR) community joined with the International Atomic Energy Agency (IAEA) to further this international objective by launching an IAEA-coordinated research project (CRP) to coordinate global activities to convert MNSRs to LEU in 2006.

MNSRs are low power (nominal 30 kW) research reactors designed and manufactured by the China Institute of Atomic Energy (CIAE). MNSRs are mainly used for neutron activation analysis, training, and testing of nuclear instrumentation. The first MNSR, the Prototype at the CIAE facility in Beijing, was put into operation in 1984. Eight other MNSRs were built in China and other countries and fuelled with HEU (~ 90%), with a design slightly different from the Prototype.

As a result of the IAEA CRP, a viable design was found to convert the MNSRs from their original HEU fuel enriched to 90 wt% uranium-235 to an LEU fuel enriched to 13 wt% uranium-235 with no degradation in overall reactor performance. Representatives from each country with an MNSR participated in the CRP, along with representatives from the U.S. Department of Energy (DOE) and the U.S. national laboratories. At the conclusion of the CRP in 2010, it was decided to establish an MNSR Working Group among MNSR operators, designers, and stakeholders to continue the work of the CRP.

The primary objective of the working group is to coordinate activities related to the conversion of MNSRs to LEU and the return of the HEU to China. Since the successful conclusion of this CRP and establishment of the Working Group, there have been three successful conversions of MNSRs from HEU fuel to LEU fuel –the prototype at the CIAE, the Ghana Research Reactor 1 (GHARR-1), and the Nigeria Research Reactor 1 (NIRR-1).

In contrast with decades of previous conversion projects in the RERTR program which have been managed on a largely bilateral basis, the MNSR conversion projects have been noteworthy for their reliance on multiple international stakeholders. The multilateral nature of the conversion projects, as well as the completion of three conversions in three years, have allowed for the iterative development and clarification of the multilateral process for planning and implementing these conversion projects. The success of these projects is defined by multilateral cooperation on conversion feasibility analysis, early definition of regulatory and bureaucratic procedures, and frequent, regular communication among stakeholders.

## Gender

Not Specified

## State

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**Track Classification:** PP: Minimization, on a voluntary basis, of high enriched uranium within civilian stocks and where technically and economically feasible