High level long lived vitrified radioactive waste loaded SS canisters/overpacks disposed at 400-500m depth in granitic rocks of a geological disposal facility trigger complex interaction and coupling of Thermal-Mechanical-Hydraulic-Radiological-Chemical processes (TMHRC) at depth in multi component system involving canister-glass-buffer smectite clays-granites-groundwater. A detail understanding of these coupling of these processes and their numerical modeling over extended period of time thus form key component of the safety assessment of geological disposal facilities. A two days NRG-BRNS seminar on laboratory scale Thermal-Mechanical-Hydraulic-Radiological-Chemical experiments on granites and smectite clays related to geological disposal of radioactive waste (TMHRC-15) was therefore organized during 21-22 July 2015 at Conference Hall, HBNI, Anushaktinagar. The seminar comprised two technical sessions with a total of 21 presentations.

The key objectives of the seminar were to provide a forum for discussion amongst in-house and leading national experts on various field and laboratory scale studies/experiments carried out in last three decades in the field of geological disposal of radioactive wastes in Indian case and identify focus area of research and development for next decade.

The seminar mainly focused on measurement and modeling of complex TMHRCH processes that would operate around disposed high level waste canister in the depth range of 500-600m in suitable rock types. Technical Presentations made during the meeting included site selection and characterization, granite characterization at elevated temperatures, Importance of Underground Research Laboratory (URL), natural analogues of waste forms and repository processes, glass alteration and modeling, sorption of actinides and fission products on smectite clays, contaminant transport and modeling, impact of radiation and heat on barrier function of clays, numerical modeling of TMH processes using various codes, seismic considerations in geological repository, repository construction and design, international development in geological disposal projects, key URL based and lab scale experiments etc.

Dr R.K. Singh DS and Associate Director (Retd), RDDG, chief guest of the seminar, dwelt upon complicacy involved in up scaling of geo-scientific data from lab scale to field scale and also highlighted the challenges involved in TMHRC coupling and validation of results through experiments. Shri R.S. Soni, Head TDD delivered the welcome address and highlighted the importance of such experiments prior to field scale
 experiments in Underground Research Laboratory. Dr R.K. Bajpai, Convener of the seminar gave an overview of the latest international developments and progress made in the field of laboratory based TMHRC characterization and associated numerical modeling studies carried out on granites and smectite in Indian case. Shri R.K. Mathur & Shri P.K. Narayan, Ex Heads RES in their presentations covered progress made in last four decades in Indian Geological Repository programme. Dr Sumit Kumar RACD made elaborate presentation on sorption characteristics of smectite clays based on their laboratory based experiments. He presented first time data on sorption of Pu, Am, Sr, Cs and Na on Indian clays. Dr C.P. Kaushik CS WMD gave an overview of radioactive waste management in India. Dr D. Datta Head CRPC made an elaborate presentation on latest numerical methods for TMHRC processes including ANN techniques.

Dr A.K. Verma of Indian School of Mines, Dhanbad, Dept. of Earth Sciences and Prof. T.N. Singh, IIT Mumbai also made detail presentations on TMHRC modeling Indian reference disposal system using FLAC, PFC, COMSOL and other codes including cases of single and multiple canister and evolution of thermal fields. Dr R.K. Goel, Scientist In charge, Central Mining and Fuel Research Institute, Roorkee, explained experimental and modeling work carried out on Indian granites for their thermal and hydraulic characterization together with full scale repository thermal modeling results. Prof JP Shirvastava, Dept. of Geology Delhi University in his talk covered experimental studies carried out on Na borosilicate alteration using Parr Reactor and their comparison with natural glasses. He reported cases of natural analogues of waste glasses discovered for the first time jointly by Delhi University and BARC. Dr RK Bajpai in his technical presentation explained the key areas in the field of geological disposal of radioactive waste and various laboratory based experiments that need to be taken up in near future.

The seminar also included a panel discussion wherein expert panelists from BARC and other national institutes discussed the importance of TMHRC processes and need for development of technology and methodology through few key experiments in laboratory prior to their field scale versions in Indian context. The recommended experiments included block scale experiments on granite block of 60cmX60cmx60cm size with cocktail of tracers like Am-Pu-U-Sr-Cs. It was also recommended to conduct granite block scale radionuclide migration experiments to optimize the field scale tests planned in future. Expert panel also made recommendation to characterize all the smectite clay deposits available in India for their basic physico-chemical and mineralogical characteristics.