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For many years, the CEA-Marcoule has developed various processes dedicated to radioactive waste confinement, especially vitrification. For 10 years now, induction heating, fluid mechanics and thermal simulations take part of all new R&D projects. The contribution to such simulations is, first, the enhancement of the working knowledge of existing processes. Those data are very useful to define optimisation choices. Second, the simulations are used at the conception stage of new processes as a tool allowing wide ranges parametric tests. This has been extensively used in the design of the cold crucible inductive melter (CCIM) commissioned in 2010 at AREVA La Hague plant. Whatever the purpose, potential benefits of reliability, output capacity and life time can be obtained. The simulation skills of the laboratory have been promoted since the early stage of the vitrification processes development. In the 80s, numerical simulations dedicated to electromagnetic studies helped design the high frequency generator for induction heating and then thermal simulations were conducted to ensure the temperature of glass melts and check furnace performance. The first flow simulations of molten glass were conducted in the 90s to verify thermal homogeneity on simplified configurations, essentially bidimensional. The outstanding increase of computation capacity which occurred these last 15 years coupled to the increased capabilities of the modelisation softwares, allows us to be much more ambitious. Nowadays we use tools able to simulate induction heating from low to high frequency coupled to thermal simulation with the Joule power density in the metallic part of the process as well as in the molten glass itself. On the other hand, two conditions are absolutely necessary to ensure the relevance of such complex numerical simulations : reliable data on physical properties and experimental confrontations. Special efforts have to be done to fulfill those two conditions. The characterisation of nuclear glass is performed thanks to specific instrumentations and experimental confrontation is done with the combination of (i) full scale tests on inactive pilots and (ii) small scale tests on analytical equipement.