Geophysical Research Abstracts,
Vol. 11, EGU2009-13776, 2009
EGU General Assembly 2009

Hydraulic-gas transient processes within the overall phenomenological evolution of the French HLW deep geological disposal: current knowledge in PA perspective

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Because of the creation of the disposal underground facilities, then of the ventilation of whole or part of these facilities during operating period, and finally of hydrogen production, mainly by anoxic corrosion of metallic components, in post-closure period, the phenomenological evolution of a radwaste deep geological repository and its surrounding host rock will be characterized by an hydraulic and gas transient phase until the overall system reach an equilibrium state.

This paper presents the analysis of this transient phase carried out in France within the framework of the feasibility study of a HLW and ILLW deep geological disposal in the Callovo-Oxfordian clay layer (Meuse/Haute Marne site) (Dossier 2005 Argile) according to the current state of knowledge: the broad outlines of the expected evolution are described in time and space from operating period to post closure period, taking into consideration the studied design concept (overall architecture, disposal zones, disposal modules, disposal cells, various types of waste, operating conditions...). More particularly for hydrogen, emphasis is focused on space and time organization of production and migration, in particular the various sources of production, the various pathways of migrations and interactions with hydraulics.

Although the description is supported by a sound data base on hydraulic and gas production and migration (clay media, engineered materials, corrosion, radiolysis...) and numerical calculations at different scales of time and space, uncertainties exist both in phenomenology (Hydrogen production mechanisms, Hydrogen migration mechanisms in clay media, modeling of mechanisms, values of parameters...) and in simulation (in particular limitations to achieve the various time and space scales and some couplings). So deviations of the expected evolution are discussed.

Results of this analysis show that the hydraulic and gas transient phase may present a complex organization in time and space, and may relate to significant scales of time, several tens of thousands to one hundred of thousands years. So the hydraulic - gas transient has to be put in prospective for other processes involved in the phenomenological evolution (thermal, mechanics and chemical processes), so to evaluate if there are the interactions/couplings or not between all these processes in time and space. In particular effect of hydraulic – gas processes on degradation of waste, release and then migration of radionuclide are discussed in PA perspective.

In conclusion, ways of progress to describe the hydraulic and gas transient phase are indicated, in view of the demand of a licensing authorization of a repository in 2014.