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PROJECTE DE DOCTORAT INDUSTRIAL EXPEDIENT 2016 DI 072

DADES DE L'EMPRESA I DE L'ENTORN ACADÈMIC

Títol del projecte

Application of Coupled Thermo-Hydro-Mechanical Simulation in Landfill Operation and Maintenance

Empresa

Pro Geo - Consultores Geotécnicos Asociados SL

Responsable de l'empresa

Angel Juan Garcia-Fontanet Molina

Universitat

Universitat Politècnica de Catalunya

Director/a de tesi

Marcos Arroyo Álvarez De Toledo

Treballador/a de l'empresa i doctorand/a

Andreu Isus Barbal

BREU DESCRIPCIÓ DEL PROJECTE DE RECERCA

Landfill deposits of municipal solid waste and industrial waste are designed for long term environmental compatibility and operational efficiency. One aspect of design that has recently gained more attention is that of heat generation within the waste and its effects on the long term performance of the containment (bottom liner and cover liner) and the optimization of exploitation (gas cogeneration) . The main source of heat in landfills are different exothermic reactions taking place within the waste. Decomposition of organic wastes generates heat during both th anaerobic and anaerobic phases; industrial and mining wastes may also react after storage. The heat generated within the landfill does affect the rate of gas generation and the settlement of the waste, it may also affect negatively the hydraulic integrity of compacted clay and geosynthetic clay liners that form its primary containment barrier and also of the clay liners that are designed as capping layers. To better control those processes as well as to exploit the heat generated as a possible source of energy there are ongoing efforts to manage heat generation within the landfill by means of heat exchangers and pumps.

To address many of these problems in realistic scenarios numerical analysis is a requisite tool. In particular numerical tools able to analyze coupled termo-hydro-mechanical (THM) problems appear inevitable. One such tool is CODE_BRIGTH a code developed at UPC specifically for the analysis of thermo-hydro-mechanical problems in geomaterials. CODE_Bright has been applied extensively for analysis and design of nuclear waste containment facilities, facilities for which the potential problems caused for heat generation and associated effects on the containment barriers are central to design. On the other hand, much less work has been done on the application of that



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code to study the similar problem on the more mundane setting of industrial and urban waste landfills. To perform this work requires a considerable effort. Neither the heat source nor the components or geometry of the isolating barriers are similar in landfills to those relevant for nuclear waste. The impact of weather conditions is also far more direct on landfill elements.

The doctoral student selected for this project will use CODE_BRIGHT to analyze several problems associated with heat generation in landfills. It will identify the main aspects in which the numerical analysis will contribute to design. It will select a number of case histories to validate and document the performance of the code in this context. It will identify the associated material properties that would be required for application in newer cases, proposing a hierarchical approach for their measurement and/or backanalysis, taking into account regulatory and economical constraints. The student is expected to end the project with a sound knowledge of both landfill design and applied THM numerical analysis.