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Evaluation of Thermal-Hydraulic-Mechanical-Biochemical Processes in Waste Landfills through InSAR Techniques

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ABSTRACT

Waste containment systems are designed to store disposed material in the long term separated from the environment. One of the main concerns regarding the integrity of these containing systems is the unpredicted post-closure settlements which can cause various problems such as cracks and failure to the surface cover system and subsequent leak of contaminants. Also, settlement prediction is critical for long-term land redevelopment plans and safety issues. In this paper, the settlement in a coal combustion product (CCP) landfill in Orlando was attempted to be analyzed using the data obtained from the Interferometric Synthetic Aperture Radar (InSAR) technique. Next, the data was compared to the prediction of the settlement with numerical modeling employing input parameters obtained from the laboratory test. Since a solar panel system was installed on top of the closed CCP landfill on an area of around 16 acres as part of the plan of transitioning to renewable energy in 2016, more than 10 mm per year were discovered. The excess overburden pressure resulting from the installation of the concrete pads (up to 1600 kg per pad) has been identified as the driving factor for inducing creep settlement to the dumped CCP. Coal combustion ash samples (including fly ash and bottom ash) were tested in a laboratory for index geotechnical properties including unit weight and specific gravity as well as for short-term and long-term compression characteristics using the one-dimensional consolidation oedometer. The input parameters obtained from the experiments were used to estimate long-term settlement ranges of the multiple layers of the landfill body

and then the results will be compared with InSAR data. The comparison of the results will help to evaluate the performance of InSAR as an accurate and cost-effective method in monitoring landfill subsidence of waste landfill systems.