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INSPECTION OF DEEP-SEATED FIRE WITHIN WASTE DISPOSAL SITE BY INFRARED THERMOGRAPHY

Problem of fires at landfills are known to occur frequently all over the world. These fires can originate from within the waste mass and are not visible on the surface, so the term 'deep-seated fire' is sometimes used. Sources of ignition can include local chemical processes or the burial of hot material within the waste. Once a fire is started, the oxidation of, e.g. organic material can provide enough oxygen for the fire to became self-sustaining. Since heat is generated during this process, the temperature of the waste increases forming so-called hot spots. Elevated temperatures can lead to smouldering combustion, but this does not necessarily produce smoke and flames. However, if enough oxygen is delivered into the waste flaming combustion can occur. Besides, existence of hot spots is likely to have different environmental impacts such as an increase in the range of trace gasses emitted, an increase in odour nuisance, an increase in emissions to the atmosphere due to increased permeability of the cover, failure of the sides or base of the landfill allowing leachate into the ground, etc.

The detection of hot spots can be made through periodical surveys, mainly based on visual inspections or, less frequently, on monitoring systems. As oxygen is available in limited quantities, complete combustion cannot be achieved, resulting in the formation of carbon monoxide and other products of incomplete oxidation. Therefore, monitoring the carbon monoxide content in gasses from the waste is a method of detecting smouldering fire. The extent of a smouldering fire is usually determined by temperature measurements. Monitoring the surface temperature by thermal imaging can provide an indication of the area and location of increased temperatures. The depth and temperatures in the core of the fire are usually determined using thermocouples.

This paper presents the results temperature measurements at a municipal waste disposal site in Croatia, where indications of smouldering fire were detected by settlement of the top of the landfill cover at several locations and the smell of burning was felt locally. At the time the fire was discovered, the landfill in question was undergoing a remediation process which included the installation of a system of gas wells for passive degassing and the covering the waste with the capping layer. At the time of field-testing, the capping layer consisted of an approximately 20 - 30 cm thick gas drainage system of crushed gravel placed on top of the waste and a geosynthetic clay liner.

Field measurements consisted of a surface temperature assessment using infrared thermography to locate the area of the landfill affected by a potential deep-seated fire. In addition, boreholes were drilled to a depth of 9 m at four locations and the temperature profile was recorded by thermocouples. The results showed that infrared thermography was a useful method of identifying hot spots at the landfill in question.