science summary

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Review and Investigation of Deep-Seated Fires within Landfill Sites

Summary SC010066/SS

Taking steps to prevent a landfill fire from occurring is much less expensive and environmentally damaging than trying to extinguish a fire after it has become established, say Environment Agency-sponsored researchers. This is one of the main conclusions of a study reviewing the occurrence of landfill fires in the UK and the practical solutions that have been employed to deal with them.

The exact frequency with which landfill fires occur in the UK is unknown, but they are far from being rare events. According to the researchers, over the past few years 78 'hot spots' have been detected in UK landfills. Hot spots are defined as areas of landfill waste generating excess heat; these areas may be smouldering or actually on fire, but need not be.

The actual number of hot spots in UK landfills is probably much higher, because hot spots can persist for years within a mass of waste without being detected. Nevertheless, relatively little research has been conducted, either in the UK or internationally, into the occurrence, characteristics and effects of hot spots in landfills. This led the Environment Agency to initiate a study into landfill fires, which involved a comprehensive literature review and a wide ranging survey of UK landfill operators regarding their experiences of hot spots.

Hot spots in landfill can develop in a number of ways. The simplest involves the burial of either hot waste or easily combustible material, such as alcoholic drinks or cleaning products. But natural decomposition processes, both chemical and biological, can also generate a great deal of heat, which often builds up because it cannot escape through the compacted waste. The material in these hot spots can then catch fire if the temperature becomes high enough, or if the hot spot becomes exposed to oxygen or an ignition trigger, such as a spark or lighted cigarette.

Although hot spots may persist for years without being detected or causing any problems, they can also have a number of potentially detrimental effects. These include: causing areas of the landfill to collapse; damaging physical structures within the landfill, such as the gas extraction system; and generating a range of chemical pollutants.

The researchers found that UK landfill operators used a variety of techniques to detect and locate hot spots. These include: spotting physical changes to the landfill; using thermal cameras to monitor the temperature across the landfill surface; inserting temperature probes to monitor the temperature deep within the waste; and recording changes in the emission of a range of gases, including oxygen, hydrogen and carbon monoxide.

They also found that operators have a wide range of options available for dealing with a hot spot. As an initial measure, most operators switch off or turn down their systems for extracting gas from the landfill, in case these systems are drawing air into the landfill and thereby feeding oxygen to the hot spot. To extinguish the hot spot, operators can: physically extract the hot spot from the landfill and then put it out; inject water into the landfill to douse the hot spot; allow the natural water level in the landfill to rise and douse the hot spot; or inject other cooling fluids, such as liquid carbon dioxide or liquid nitrogen, into the landfill.

All of these options have their advantages and disadvantages. For instance, physical extraction runs the risk of the hot spot bursting into flames on exposure to the air, while injecting water or other cooling liquids requires the operator to know the exact location of the hot spot. In addition, extinguishing a hot spot is an expensive process, which can cost up to £1 million.

The researchers therefore conclude that it is best to prevent a hot spot from developing in the first place. This can be done by regularly monitoring gas emissions and avoiding the introduction of hot material to the landfill.

The report of this study contains detailed information on all the available techniques for detecting and extinguishing a hot spot, and also outlines the theory of hot spot development. In addition, it contains a number of real-world case studies, which detail the experiences of landfill operators from around the world in dealing with hot spots.

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