Inductive Thermal: Dynamic Stripping Process

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Background/Objectives. Contaminated soils are a significant environmental and safety concern. Many contaminants have the ability to flow into aquifer systems, thereby contaminating the public water supply. The depth at which some contaminants occur renders the use of excavation prohibitively expensive. Therefore, methods are employed to remove contaminants in situ, where depth is not a factor. Such methods include heating the soil using electricity or combustion means in order to vaporize contaminants, which are subsequently extracted from the soil. Current soil heating technologies are based on the following principles: (1) passing an electric current through heater elements to heat the soil through conduction, (2) combustion of fuel inside an underground pipeline, and (3) passing an electric current through the soil between several electrodes, wherein heat is generated through Joule heating of the soil. For the electric heater element and combustion heating technologies, cost considerations limit the heating elements and pipelines to a small diameter. Additionally, it is difficult to control the boundary temperature throughout the vertical extent of the well bore for selective heating of different vertical extents of the element/pipeline to different temperatures. Further, the heating equipment used in such operations are sunk costs, as they are typically left in the ground after a remediation project is completed. ET-DSP™ and similar technologies are only capable of remediation of a limited number of contaminants, as the soil temperature is limited to the boiling point of water, which can be less than the temperature needed to achieve thermal remediation of certain types of contaminants.

Approach/Activities. There is a need for an economical method and device for heating soil that provides a large heating surface area, enables the selective heating of vertical extents of the element to different temperatures, and is capable of achieving soil temperatures sufficient to remediate contaminants with high boiling points, while allowing for recovery of at least some of the heating equipment after operations have concluded. McMillan-McGee Corp. has developed an inductive heating device for penetrating from ground surface into soil to heat the soil, comprising: a power source configured to provide a high frequency alternating driving current; a tubular casing made of a conductive material, having a closed end and an open end and at the open end; at least one conductor called the work coil, connected to the power source and located within, and electrically isolated from, the casing. The work coil is configured to create an induced circumferential current in the casing; wherein the driving current is of a frequency sufficient for the induced current to generate sufficient resistance in the casing to heat the casing.

Results/Lessons Learned. McMillan-McGee Corp. has developed a system for heating one or more zones of soil below ground surface, the system comprising: an array of the inductive heating devices described above, arranged and configured to cooperatively heat the zones of soil. The heating devices are arranged into an array of equilateral triangles, each heating device in a triangle spaced about 5 meters apart from the other heating devices. Inductive thermal dynamic stripping process is ideally suited for remediation cases when elevated temperatures are required to volatilize contaminants and/or treat soil that has a high electrical conductivity.