2.1.5.2 In-Situ Vitrification

In-situ vitrification earth-melting technology was developed by Battelle Memorial Institute during the 1980s for DOE and is now commercially available as Geosafe Corporation's GeoMelt™ technology. In-situ vitrification treats contaminated materials where they presently exist. This method is preferred when it is necessary to avoid the risks associated with excavation of the waste. The vitrification process can simultaneously treat wastes with high concentrations of both organic and inorganic (e.g., heavy metal) contaminants. Organic constituents are thermally desorbed and then destroyed by thermal decomposition (pyrolysis) within the oxygen-depleted media being treated. Nonvolatile inorganics (metals) are typically incorporated into the melt and the resulting vitrified product. Such incorporation occurs within the framework of the glassy product itself, as opposed to simple encapsulation (being surrounded) by the glass. A large volume reduction (25-50% for soils) occurs due to elimination of void volume and vaporizable materials during processing. This process works best with treatment zones that are >10 feet in thickness.

In-situ vitrification hoods.

Off-gas hoods are used to cover an area of contaminated soil. The process works by melting soil in place using electricity applied between pairs of graphite electrodes. The process employs joule heating and typically operates in the range of 1,600 to 2,000° Celsius (C) for most earthen materials. A highly conductive starter path is placed between the electrodes to allow initiation of melting. As electricity flows through the starter path, the path heats up and causes the surrounding media to melt. Once the media is molten, it too becomes electrically conductive. Continued application of electricity results in joule heating within the molten media between the electrodes. After the melt is fully established, the melt zone grows steadily downward and outward through the contaminated volume. Successful melting is contingent upon the use of adequate electrical conductivity. Additives including lime, soda, ash, or pre-manufactured glass frit may be used to improve performance.

A low vacuum can be pulled on the hood in operation to capture emissions from the melt and send them to the off-gas treatment system, which may include a quencher, scrubber, demister, heater, particulate filter, blower, and optional activated carbon or thermal oxidation units. The entire ISV system can be monitored from a process control room.