treatment of contaminated soils is generally conducted in-situ. A description of both ex-situ and in-situ vitrification processes follows.

2.1.5.1 Ex-Situ Vitrification

The ex-situ vitrification process is a thermal treatment process that both oxidizes and vitrifies wastes. It can treat wastes in the form of solids or as slurries. Typically waste and fuel are mixed in a pre-combustor before being transferred to a combustion chamber. Oxidation will take place in the combustion chamber. After the waste has been oxidized the ash is transferred to a vitrification chamber where it is mixed with glass making ingredients to create glass materials. In some systems, wastes treated this way are reportedly capable of passing the toxicity characteristic leaching procedure (TCLP).

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.
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.

### 2.1.6 Rotary Metal Parts Treatment Unit

Rotary metal parts treatment (RMPT) is used in the decontamination of empty projectile and mortar shells. The RMPT consists of a cylindrical structure rotating at a prescribed speed inside a cylindrical furnace. The dimensions of the RMPT are 4 feet, 8-inches inner diameter by 15 feet, 7-inches in length with design conditions of 15 psig/full vacuum at 1,500 °F. The inside cylinder contains 15 cages which are evenly distributed around a 36-inch outside diameter inner pipe, supported and strengthened by baffles. Each cage is constructed with three ½-inch diameter stainless steel rods, positioned at a 120-degree angle and parallel in the axial direction. The size of the cages is dependant on the different munitions and mortars to be treated.