2.1.2 Thermal Treatment

Thermal treatment utilizing the MITU is very similar to Low Temperature Thermal Desorption (LTTD) technologies; however, the MITU offers some distinct advantages over LTTD and other volatilization technologies that will be discussed later. The MITU's thermal treatment process is designed to operate on the same principles as LTTD; that is to heat the soils to a sufficient temperature to cause constituents to volatilize and desorb from the soil.

VOC contamination in vadose zone soils is distributed among three phases of the soil matrix. The distribution of the contamination depends on the soil characteristics as well as the specific contaminants of concern. The movement of contaminants through the soil media is either by advection, movement with bulk air flow, or by diffusion, movement via concentration gradient. Volatile compounds desorb from the soil particle surface, transfer to the soil water, and volatilize to the soil gas. In low to medium permeable soils (sand and gravel), diffusion is the limiting factor in the movement and re-movement of contaminants

Thermal treatment with the MITU does not require excavation of contaminated soils; the thermal treatment can be performed in-place or on excavated soils. The underlying feature of successful thermal treatment with the MITU is its ability to break down soil density. The shearing action of the trencher pulverizes the soil into very fine particles, effectively increasing the

surface area to volume ratio. In turn, the constituents are more readily volatilized by virtue of increased contact with air flow and heat.

Thermal Treatment with MITU 12 Protective/Vapor Recovery Hood

The MITU utilizes an electrically powered heat generation system to heat forced air to temperatures in excess of 800°F (425°C). The forced air is then conveyed into the trench and across the soil particles. The final soil temperature depends on the soil characteristics and on retention time.

The vaporized constituents are captured beneath a enclosed shroud, that is subjected to negative pressure, and are treated in a secondary treatment unit prior to discharge to the atmosphere. Secondary treatment of the vaporized constituents may consist of condenser units, catalytic or thermal oxidation, and carbon adsorption units.

The trenching head, heat generation system, and vapor collection system are all operated through an integrated control panel mounted in the equipment's cab. Several of the system's parameters can be monitored during operation to maintain operational control and optimize treatment effectiveness. (see Figures 2.1 and 2.2)

View of Power Unit & Heat Generation System on MITU 12

The temperature of the forced air stream utilized for thermal treatment is monitored and can be adjusted if necessary. Organic vapors are monitored prior to and after secondary treatment of the vapor stream in order to monitor and adjust treatment as necessary. Explosive atmosphere (% LEL) is also monitored within the vapor collection shroud in order to detect potentially dangerous conditions.

Soil heating technologies have proven to remove over 98% of volatile and semivolatile aliphatic and aromatic compounds by achieving soil temperatures of 150° C. The MITU heat generation system operates at continuous temperatures in excess of 400° C. The technology has had very favorable results in the field displaying consistency with the 98% removal efficiency accomplished by soil heating technologies. The process has also been demonstrated to be equally successful at removing chlorinated solvents, specifically PCE and its daughter products. Some typical contaminant removal results achieved through thermal treatment with the MITU are displayed in Table 2.1.

Table 2.1: Typical Thermal Remediation Results

Contaminant	Pre-Treatment (mg/kg)	Post Treatment (mg/kg)	% Reduction
Benzene	5.6	0.005	99.9%
Toluene	270	0.05	99.9%
Ethyl Benzene	54.5	0.97	98.2%
Xylene	324	4.5	98.6%
PCE	369	18.1	95%
TCE	25	.5	98%

Data is compiled from 1998 project completed for HSI Geotrans in Arcade, NY

Some advantages of thermal treatment with the MITU technology over LTTD and various in-situ volatilization technologies are as follows:

- The equipment is readily available
- The MITU is easily mobilized to most sites
- Can be used to treat "hot spot" source areas with minimal site disturbance
- The MITU is effective in most soil types
- Excavation of soils is not required for treatment
- Pre-treatment of soils is not required
- The MITU is easily and readily combined with other remedial technologies
- Eliminates the need for procurement and placement of backfill material