1.INTRODUCTION

Creosote, a compound containing 85% polycyclic aromatic hydrocarbons (PAHs) by weight, is commonly used in the wood-preserving industry to treat railroad ties and timbers for marine use (Mueller *et al.*, 1989). Creosote is produced in coke ovens and contains substantial amounts of benzo(a)pyrene and other PAHs (ATSDRc, 1990). Creosote is characterized as a dense, non-aqueous phase liquid (DNAPL) that has contaminated soil and ground water at many wood-preserving sites. Of the 1,350 hazardous waste sites placed on the National Priority List (NPL) by the United States Environmental Protection Agency (USEPA), PAHs have been identified at 585 of those sites (ATSDRa, 1993). The USEPA has listed PAHs as priority pollutants, since some are considered potential carcinogens and mutagens. In the 1992 Toxic Release Inventory, USEPA classified coal tar creosote as a probable human carcinogen. PAHs normally have a low degree of human toxicity and many are slightly mutagenic or nonmutagenic. However, PAH metabolites or derivatives may act as strong mutagens and interaction with DNA can lead to PAH-related carcinogenesis (ATSDRc, 1990).

Remediation of PAHs and other hydrophobic compounds at hazardous waste sites has always been a difficult task. The chemical composition of PAHs tends to limit bioavailability, especially at sites with aged contaminants. The location of the site in this study is Oneida, Tennessee. The Norfolk Southern Corporation currently owns the site. In the 1950s, a creosote facility was established at the site to treat wooden cross-ties. The facility was operational for about 15 years. In 1990, creosote contamination was detected in a creek adjoining

the property. From 1991 to 1995, several consulting firms sampled site soil and ground water and surface water and sediment from the creek. In 1997, Norfolk Southern selected Geraghty & Miller, Inc., to provide further investigative services and a remedial action plan for the site. In June 1997, Virginia Tech was chosen to provide additional research services and assess the phytoremediation effects of grasses and poplar trees at the site.

Phytoremediation, a recent and innovative form of bioremediation technology, employs the use of green plants to degrade contaminants. Phytoremediation has been successfully used to aid in degradation of several environmental contaminants, such as herbicides, pesticides, and trinitrotoluene (TNT) and other explosive-related compounds (Matso, 1995; Cunningham *et al*., 1996). Phytoremediation degrades contaminants in two ways. Direct phytoremediation involves actual uptake of the contaminant into the root structure, subsequent plant metabolism, and either volatilization or incorporation of the degradation by-products into the plant structure. Indirect phytoremediation, a.k.a. rhizosphere remediation, entails augmentation of microbial populations in the plant root zone that are capable of contaminant degradation. Root exudates and decomposing root materials contain readily degradable carbon-containing byproducts that support growth and activity of larger contaminant-degrading microbial communities. Implementation of phytoremediation at PAH or creosote-contaminated sites is sparse and phytoremediation field studies are limited.

The objectives of this study are: 1) characterize the site with respect to soil PAH concentrations; 2) assess the effects of phytoremediation on creosote-contaminated surface soils over one growing season.