THE TENNESSEE VALLEY AUTHORITY WIDOWS CREEK WETLAND TREATMENT SYSTEM

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ABSTRACT

The Tennessee Valley Authority constructed the Widows Creek wetland treatment system (TV A wetland) in 1986. The wetland was implemented to treat run-off and leachate from coal and coal combustion by-product storage piles. The wetland was comprised of three cells (Cells 1, 2, and 3) designed to treat wastewater supplied at an average annual inflow rate of 4,200 liters per hour. The 15-month study of the role of plants in trace element removal presented here focussed on Cells 1 and 2 (considered to be the most important for removal) with a total impounded area of 3,250 m2. These two cells were dominated by monotypic stands of cattail *(Typha latifolia),* with smaller areas of soft rush *(Juncus effusus).* Sixteen elements (Al, B, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, S, Sn, Sr, V, and Zn) were present at elevated concentrations in the influent water, resulting in a large annual loading of each of these elements. The highest of these were S and Fe at 17,550 and 3,479 kg per year, respectively. The wetland slightly reduced the electrical conductivity of the water, but had little effect on its pH or dissolved oxygen concentration. The TV A wetland was successful at removing 25 to 50 % of most of the elements, and up to 90% for Fe, Cd, V, and Cr. There was a greater removal of trace elements in Cell 1 compared to Cell 2. The sediment was the primary sink for all trace elements, retaining 94 to 99.9% of those elements removed from the wastewater. The accumulation of trace elements in plant shoots accounted for 0.1 to 6 % of the trace elements removed from the wastewater. Plants are very important for trace element removal because they enhance I) microbial transformations of trace elements by providing fixed carbon and nitrogen, 2) sedimentation rates, 3) sediment stability, and 4) physical filtration of particulates from the water. The significance of this research is discussed in relation to wetland design criteria.