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Dissertation Year: 2007

Title: Remote Sensing Investigations Of Fugitive Soil Arsenic And Its Effects On Vegetation Reflectance

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ABSTRACT

Three different remote sensing technologies were evaluated in support of the remediation of fugitive arsenic and other hazardous waste-related risks to human and ecological health at the Spring Valley Formerly Used Defense Site in northwest Washington D.C., an area of widespread soil arsenic contamination as a result of World War I research and development of chemical weapons. The first evaluation involved the value of information derived from the interpretation of historical aerial photographs. Historical aerial photographs dating back as far as 1918 provided a wealth of information about chemical weapons testing, storage, handling and disposal of these hazardous materials. When analyzed by a trained photo-analyst, the 1918 aerial photographs resulted in 42 features of potential interest. When compared with current remedial activities and known areas of contamination, 33 of 42 or 78.5 % of the features were spatially correlated with current areas of contamination or remedial activity. The second investigation involved the phytoremediation of arsenic through the use of *Pteris* ferns and the evaluation of the spectral properties of these ferns. Three hundred ferns were grown in controlled laboratory

conditions in soils amended with five levels (0, 20, 50, 100 and 200 parts per million) of sodium arsenate. After 20 weeks, the *Pteris* ferns were shown to have an average uptake concentration of over 4,000 parts per million each. Additionally, statistical analysis of the spectral signature from each fern showed that the frond arsenic concentration could be reasonably predicted with a linear model when the concentration was equal or greater than 500 parts per million. Third, hyperspectral imagery of Spring Valley was obtained and analyzed with a suite of spectral analysis software tools. Results showed the grasses growing in areas of known high soil arsenic could be identified and mapped at an approximate 85% level of accuracy when the hyperspectral image was processed with a linear spectral unmixing algorithm and mapped with a maximum likelihood classifier. The information provided by these various remote sensing technologies presents a non-contact and potentially important alternative to the information needs of the hazardous waste remediation process, and is an important area for future environmental research.