

Program Two  
Tuesday, May 20, 1997

Remediation of Munitions Compounds Kansa B

# 15

## PHYTOREMEDIATION OF EXPLOSIVES IN GROUND WATER AT THE MILAN ARMY AMMUNITION PLANT USING INNOVATIVE WETLANDS-BASED TREATMENT TECHNOLOGIES

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Many army ammunition plants across the country have problems with ground water contaminated with explosives. A field demonstration was initiated at the Milan Army Ammunition Plant near Milan, Tennessee early in 1996 to demonstrate the feasibility of treating contaminated ground water with constructed wetlands. Two different systems were designed and installed.

A lagoon system consists of two cells in series with each cell having dimensions of 24 x 9.4 x 0.6 m (L x W x H). A gravel-bed system consists of three gravel-beds operated in series with a primary anaerobic cell having dimensions of 32 x 11 x 1.4 m (L x W x H), followed by a pair of secondary cells each with dimensions of 5.5 x 11 x 1.4 m (L x W x H). The primary cell is maintained anaerobic by adding powdered milk to the water every two weeks.

The secondary cells are maintained aerobic via reciprocation, whereby water is pumped back and forth from one cell to another to cause a recurrent fill and drain action. The lagoons were planted with sago pond weed, water stargrass, elodea, and parrot feather. The gravel-bed wetlands were planted with canary grass, wool grass, sweet flag, and parrot feather. Water began flowing to each of the wetland treatment systems at 19 L min<sup>-1</sup> starting in June 1996.

The design hydraulic retention time through each treatment system is 10 days. Influent and effluent water samples are being collected every 2 weeks. Intensive sampling of water interior to the wetlands is occurring every 2 months. Influent concentrations of trinitrotoluene (TNT), cyclotrimethylenetrinitramine (RDX), and cyclotetramethylenetetranitramine (HMX) were approximately 3, 3, and 0.2 mg L<sup>-1</sup>, respectively.



Both the lagoon and gravel-bed wetlands are reducing TNT below 0.002 mg L<sup>-1</sup>. The gravel-bed wetland is removing RDX and HMX in the ground water, whereas the lagoon wetland is not as effective with removal efficiencies of only 47 and 20%, respectively. The presentation will include a discussion of wetland operation and data collected. Information from the demonstration will be used to recommend design and operational parameters for implementing the technology to other sites.

**Key words:** explosives, constructed wetlands, demonstration

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[Top of Page](#)

---

[Return to Main Table of Contents](#)  
(to see full list of programs and abstracts)

---

**Sub-Menu of Event Programs**  
(to see specific list of abstracts)

Tuesday, May 20, 1997

[Metals Kansa A](#)

[Remediation of Munitions Compounds Kansa B](#)

[Analytical Methods Kansa C/D](#)

[General Topics Kansa B](#)

Wednesday, May 21, 1997

[Metals Kansa A](#)

[Zero-Valent Metals Kansa A](#)

[Remediation Kansa A](#)

[Vegetation-based Remediation Kansa B](#)

[Partnerships & Innovative Technologies Kansa C/D](#)

[Nonaqueous Phase Liquids Kansa C/D](#)

Thursday, May 22, 1997

# Abstracts From The 1997 Conference on Hazardous Waste Research

## Table of Contents

Program One  
Tuesday, May 20, 1997

### Metals Kansa A

1 BENEFICIAL EFFECTS OF PHOSPHATE AMENDMENTS IN METALS-  
CONTAMINATED SOILS

2 EFFECT OF VEGETATION ON THE TRANSPORT OF HEAVY METAL IN A  
CONTAMINATED SOIL

3 DETERMINING COPPER AND LEAD BINDING IN LARREA TRIDENTATA  
THROUGH CHEMICAL MODIFICATION AND X-RAY ABSORPTION  
SPECTROSCOPY

4 ADSORPTION AND TRANSPORT OF PB IN SOIL AS AFFECTED BY ORGANIC  
LIGANDS: BATCH AND COLUMN STUDY

5 MODELING AND SIMULATION OF HEAVY METAL TRANSPORT IN  
RHIZOSPHERE SOIL: INFLUENCE OF ACTIVE BIOMASS

6 DETERMINATION OF THE ABILITY OF INACTIVATED AND IMMOBILIZED  
CELLS OF SYNECHOCOCCUS PCC 7942 (CYANOBACTERIA) TO UPTAKE METAL  
IONS FROM SOLUTION

7 MAGNETITE REMEDIATION OF HEAVY METALS FROM AQUEOUS SOLUTION

8 IMPACT OF VEGETATION ON HEAVY METAL MOVEMENT

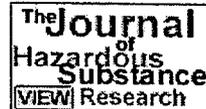
9 STUDY OF THE LIGANDS INVOLVED IN METAL BINDING TO ALFALFA  
BIOMASS

10 PRELIMINARY DESIGN OF HYDROMETALLURGICAL PROCESS FOR  
OXIDIZED WASTE TREATMENT

[Return to Publications Menu](#)

Program Two

# HSRC The Great Plains/Rocky Mountain Hazardous Substance Research Center



[Home](#) [Contact](#) [Search](#) [Publications](#) [Conferences](#) [Programs](#) [Research](#) [Phytoremediation](#) [Links](#)

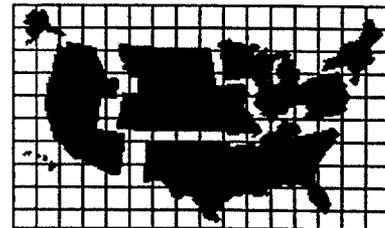
Search for:

in:  Entire Website



## Welcome to the Great Plains/Rocky Mountain Hazardous Substance Research Center

Kansas State University (KSU) leads the fourteen-institution consortium for the Great Plains/Rocky Mountain Hazardous Substance Research Center (HSRC). The other member institutions are Lincoln, Haskell Indian Nations, Colorado State, Montana State, South Dakota State, and Utah State Universities, along with the universities of Iowa, Northern Iowa, Missouri, Montana, Nebraska, Utah, and Wyoming. The center was established in 1989 to conduct research pertaining to hazardous substances produced through agriculture, forestry, mining, mineral processing, and other activities. It serves Federal Regions 7 and 8.



**The Great Plains/Rocky  
Mountain Regional Center**  
**EPA Regions 7 & 8**

Specific research projects focus on soil and water contaminated by heavy metals from mining wastes and other industrial activities, soil and groundwater contaminated by organic chemicals, wood preservatives that contaminate groundwater, pesticides identified as hazardous substances, improved technologies and methods for characterizing and analyzing contaminated soil, and waste-minimization and pollution-prevention methods and technologies.

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This site is best viewed using an 800x600 display and Microsoft Internet Explorer 6. Some portions of this site require Adobe Acrobat Reader for proper viewing.

In October of 2001, the Midwest HSRC at Purdue University and the Rocky Mountain HSRC at Colorado State University were established to continue serving the hazardous substance research and technology transfer needs of EPA Regions 5 and 7, and Region 8, respectively. The grant period for the Great Plains/Rocky Mountain center is ending, and work at this center will be completed during 2002 and 2003. Please use the links above for information on programs and activities of the new centers.

| [Home](#) | [Contact](#) | [Search](#) | [Publications](#) | [Conferences](#) | [Programs](#) | [Research](#) | [Phytoremediation](#) | [Links](#) |

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