Application of Phytoremediation to Remove Cs-137 at Argonne National Laboratory - West

Scott Lee

Scott Lee has a B.S. in civil engineering from North Dakota State University and a M.S. in environmental engineering from North Dakota State University. He has worked as an environmental engineer for Westinghouse Electric Corporation at the Naval Reactors Facility in Idaho Falls Idaho, during the cleanup of 57 CERCLA waste sites.

Scott is currently employed by Argonne National Laboratory-West as an environmental engineer. He is in charge of all 39 CERCLA sites at Argonne National Laboratory-West being remediated under the Federal Facilities Agreement and Consent Order. He is responsible for coordinating, developing, and writing all required documents including the Sampling and Analysis Plan, Remedial Investigation Work Plan, Remedial Investigation and Feasibility Study, Record of Decision, Remedial Design Remedial Action Work Plan, and the Verification Sampling Plan. In addition, Scott is managing a two-year phytoremediation demonstration project as well as the excavation and disposal activities at these two sites. A summary of the first year of the phytoremediation demonstration project at Argonne National Laboratory-West has been written and will be published in the May/June issue of Radwaste Solutions magazine.

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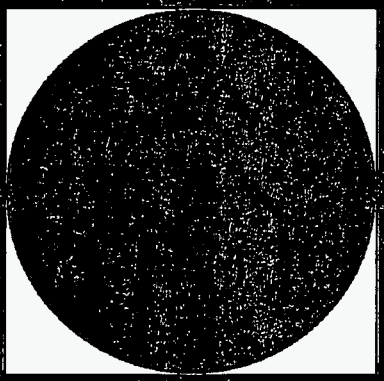
Phytoremediation Application for Radionuclide Removal at Argonne National Laboratory-West



Chicago Operations Office
U.S. Department of Energy

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Summary of WAG 9 CERCLA Activities

- Listed as NPL site in 1991
- Includes the investigation of 37 WAG 9 waste sites
- Includes the summary of 2 WAG 10 waste sites
- Involved collection and analysis of over 9,400 contaminant specific samples
- ROD signed 9-27-98

Waste Area Group 9
Contaminants of Concern

- Human — *Cesium -137*
- Ecological — *Chromium^{+3}*, *Mercury*, *Selenium*, *Silver*, *Zinc*

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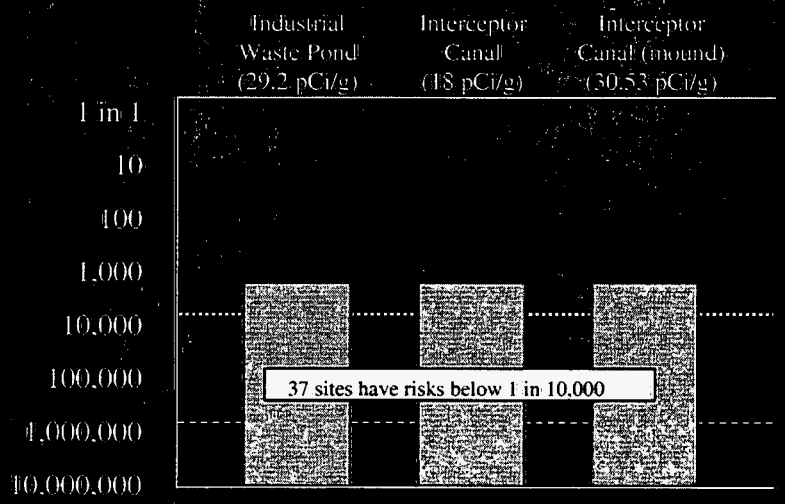
Human Health Risk Calculations
(present day occupational exposure)



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Summary of Comparative Analysis Ranking of Remedial Alternatives

Evaluation Criteria	Alternative				
	3a	4a	4a	4b	5
Overall Protection of Human Health and the Environment	meets	meets	meets	meets	meets
Compliance with Applicable and Relevant and Appropriate Requirements	good	good	good	good	best
Long-term Effectiveness and Permanence	worst	good	good	good	best
Short Term Effectiveness	worst	good	good	good	good
Reduction of Toxicity, Mobility, or Volume Through Treatment	worst	worst	worst	worst	best
Implementability	best	best	best	best	good
Cost (in millions)	7.6	5.9	5.9	13.1	2.8

Phytoremediation Obstacles

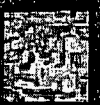
- Ecological Receptors
- Public Concerns (Homer Simpson)
- Leaching Contaminants
- Noxious Weeds

Ecological Concern

- Mitigate or eliminate the exposure pathway to ecological receptors.

Contaminant Leaching

- Design and install irrigation system
- Add additional soil moisture detectors below contaminants



Noxious Weeds

- Use of plants found in but not native to Idaho
- More harmful than beneficial
- Eradication must be economically feasible
- Adverse impact must exceed cost of control

Special Controls for Kochia Weed

- Get State approval prior to planting to control undesirable weeds
- Harvest before flower
- Establish clear zone around site
- Seed weeds to prevent wind dispersion

Preplanting Activities

- *Install irrigation lines, pressure regulators, risers, heads, and moisture probes*

- *Level the irregular shaped dredge piles (10x500x4 ft)*

- *Work the soil using the plow, ripper, and roto-tiller*

- *Addition of organic matter*

- *Collect real-time gamma emissions and map results*

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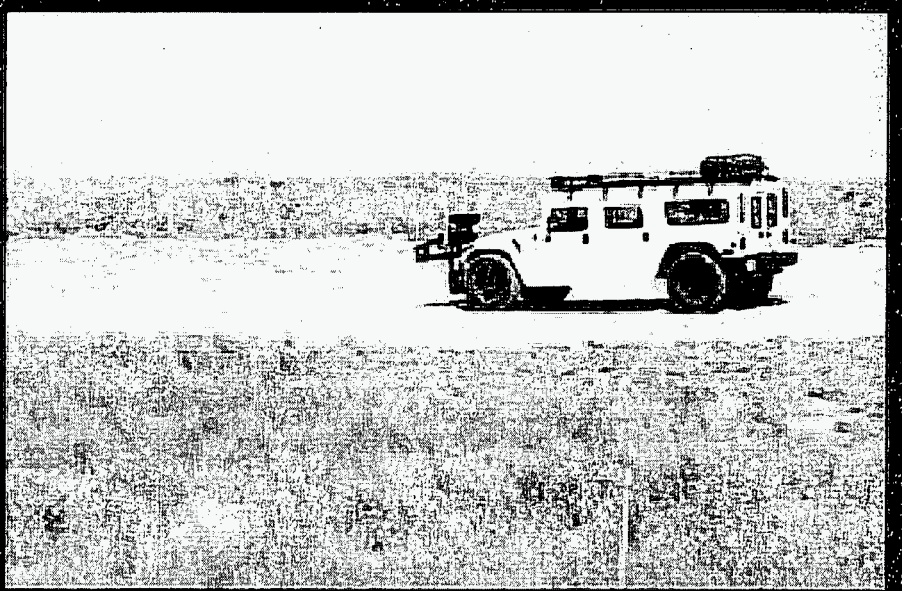
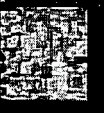
Global Positioning Radiometric Scanner (GPRS)





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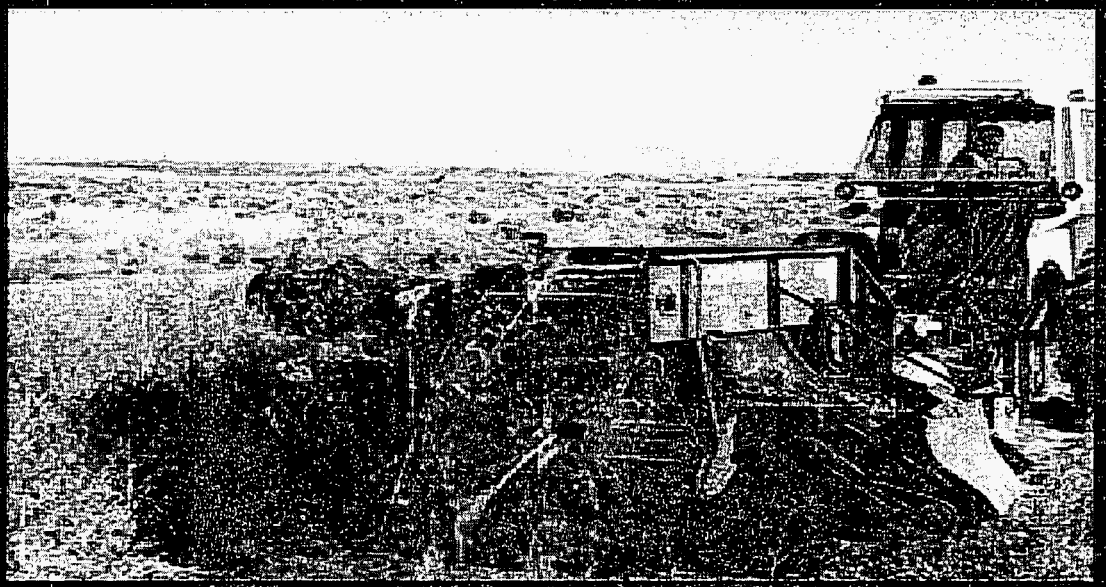
Kochia with Roots



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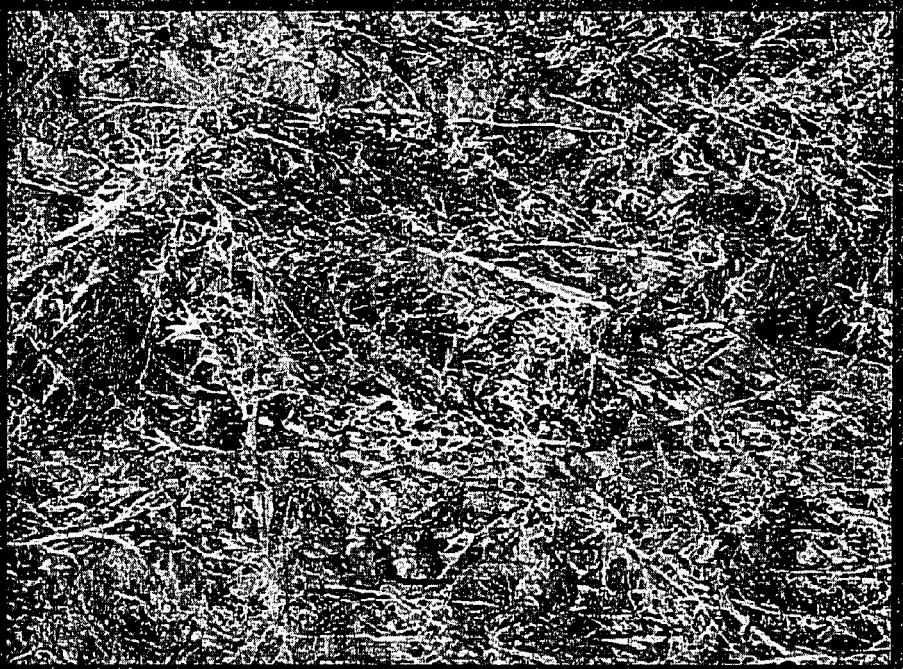
Harvested Kochia Plants



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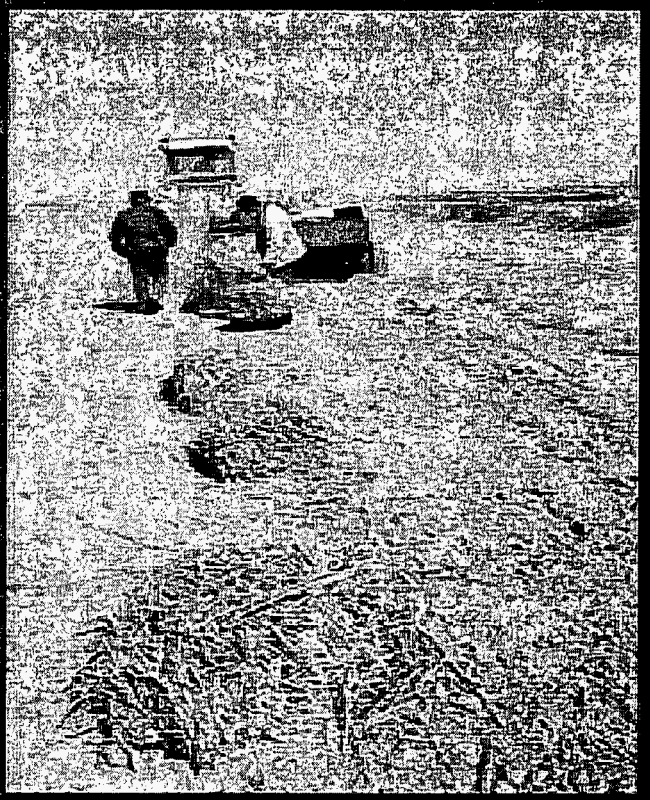
Kochia Roots

Kochia Plant



Future Activities

Establish and test three Amaranth species for comparison to Kochia *(Amaranthus: retroflexus, bicolor, and paniculatum)*

Compare the Cs-137 uptake for stress and unstressed plants prior to harvesting

Use ISSOX (directional sodium germanium detector) prior to planting, harvesting, raking, and bailing, Bale plant matter