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Barbara

Department of Energy
Los Alamos Area Office
Albuquerque Operations Office
Los Alamos, New Mexico 87544

JUL 3 1 1995

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Barbara Hoditschek, Program Manager
RCRA Permitting Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
525 Camino de los Marquez
P. O. Box 26110
Santa Fe, NM 87502

RECEIVED AUG 7 1995

Dear Ms. Hoditschek:

Subject: Treatability Studies Notification

The purpose of this letter is to provide notification of intent to conduct two related hazardous waste treatability studies at Los Alamos National Laboratory. Both studies will be conducted by the Waste Treatment and Minimization Science and Technology Group. These studies involve the treatment of soil contaminated with explosives. The first study will be conducted under controlled laboratory conditions, while the second study is conducted under in situ conditions (at the contaminant site) where the soil is subject to environmental factors.

These two studies will evaluate the effectiveness of two explosive treatment technologies. The first technology uses bioremediation as a pretreatment technology to reduce the explosive hazard of the soil. The second technology will treat the soil after bioremediation with a basic solution (e.g., sodium hydroxide) to remove the remaining explosive materials. The basic solution breaks down the explosives into carbon, carbon dioxide, water, and non-hazardous constituents. No hazardous waste is generated from the breakdown of the explosives.

After treatment, the soil will be analyzed to confirm the absence of explosive compounds. If the treatment is unsuccessful, the soil will either be retreated or managed as a hazardous waste. If analyses determine that the soil has been contaminated with radioactive nuclei and/or other Resource Conservation and Recovery Act listed substances, management of the contaminated soil will be required by the appropriate regulation governing the regulated constituents still present in the soil. A total of five hundred kilograms of soil will be treated in these studies.

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If you have any questions, please contact me at (505) 665-5042.

Sincerely,

H.L. "Jody" Plum
Office of Environment and Projects

LAAMEP:11JP-005

Enclosure:
Remediation of Soil Contaminated
with High Explosives

cc w/ enclosure:
Benito Garcia
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
525 Camino de los Marquez
P. O. Box 26110
Santa Fe, NM 87502

ENCLOSURE

Remediation of Soil Contaminated With High Explosives

Facility Name: Los Alamos National Laboratory, Chemical Science and Technology Division, CST-18, Waste Treatment and Minimization Science and Technology

Project Title: Remediation of Soil Contaminated with High Explosives

Project Contact: Pat J. Unkefer, Ph.D.; LANL; CST-18, J563
(505) 665-2556; FAX (505) 665-6936
Other Contacts: John Sanchez, Ph.D.; LANL, DX-16, C920
(505) 667-2012

Facility EPA ID Number: NM0890010515

Project Description:

Problem Being Addressed: Near areas of manufacturing, machining, and packing of explosives there are areas of soil contaminated with explosives. Most of these sites have not been remediated. Technologies being evaluated for remediation include: incineration, bioremediation, and soil washing. Incineration is expensive and requires excavation. The other two methods may be done in situ.

Objectives: Two related treatability studies will be conducted. The primary objective of these studies are to evaluate the effectiveness of bioremediation as a pretreatment technology to reduce the explosive hazard of soil and to evaluate the effectiveness of treating bioremediated soil with a basic solution to remove any remaining explosive material. The two treatability studies are: treat explosives contaminated soil with bacteria followed by treatment with a basic solution in a laboratory-scale unit at TA-9; and treat explosives contaminated soil in situ at TA-16. Bioremediation is a low cost method of in situ remediation. Explosives such as TNT, RDX, and HMX have successfully been remediated in liquid cultures. TNT can be transformed to non-explosive compounds by a bacteria obtained from the soil, Psuedomonas aeruginosa; while RDX can be biodegraded to carbon dioxide by a consortium of bacteria obtained from horse manure. TNT and RDX have also been biotransformed or biodegraded in soil slurry reactors. After one month, all of the TNT and RDX in the waste surrogate soils had degraded.
We have already demonstrated that bioremediation works by treating surrogate explosives contaminated soil in the laboratory with bacteria and basic solution. Now we will demonstrate that the bioremediation of explosives can be achieved in situ where the explosives contaminated soil is subject to environmental factors. Bacteria from horse manure and corn steep liquor, a cheap nutrient source, will be added to the soil. Samples will be withdrawn twice a week and analyzed using EPA Standard Methods for explosives and known biodegradation intermediates. After one to two months, the majority of the RDX and TNT in the soil will have degraded, thus lowering the explosive hazard of the soil. The soil can then be excavated with less hazard for the workers. Excavated soil will also be washed with a base, such as sodium hydroxide, to remove the explosives. The feasibility of combining biodegradation with base washing will also be examined. This combined technology will remove all explosives to levels below the current LANL Screening Action Levels and post-treatment analysis will be used to confirm this. If the soil is found to have rad or other RCRA regulated constituents, it will be managed appropriately after treatment.

Project Goal:

- Short Term (2 months): Demonstrate with a laboratory-scale unit, the effectiveness of bioremediation of explosives in soil, as well as the effectiveness of base soil washing.

- Long Term (1 year): Demonstrate in situ bioremediation of the explosive contaminated soil.

Project Tasks:

1. Obtain soil samples from contaminated LANL site to be tested.

2. Obtain explosives analysis of contaminated soil.
3. Grow organisms which will be added to the soil in the laboratory.
4. Perform laboratory-scale biodegradation experiments.
5. Perform laboratory-scale soil washing experiments.
6. Perform in situ bioremediation experiment.

Milestones: (Assume start date of 9/1/95)

1. Complete first sets of laboratory-scale bioremediation experiments	11/1/95
2. Complete first sets of laboratory-scale soil washing experiments	11/1/95
3. Complete in situ bioremediation experiments	9/1/96
4. Complete any subsequent laboratory-scale experiments	9/1/96

Location of Project:

TA-9, Bldg 35 (laboratory experiments)
TA-16, Behind Bldg 260 (in situ experiments)

Amount of Hazardous Material:

200 kg of contaminated soil for laboratory experiments.
300 kg of contaminated soil in situ.

Qualifications:

1. Experience:

Over the past 5 years, we have established a bioremediation program, that addresses problems such as explosives contaminated soils and waters and solvents contaminated media. The team that will participate on this project consists of a combination of chemical engineers, biologists, and biochemists. The team has taken projects from bench to full scale operation.

2. Key Staff:

(LANL Project Leader) Pat J. Unkefer, Ph. D. Biochemistry (Texas A &M University), 16 years professional experience, 11 at LANL as staff member. Experience: biological processes, microbiology, kinetics, plant and soil physiology.

(University Collaborator) Kimberly L. Ogden, Ph. D. Chemical Engineering (University of Colorado), 1 year National Laboratory (LANL), 3 years University of Arizona. Experience: biodegradation, fermentation, pharmaceuticals, transport, and kinetics.

(Explosives) John Sanchez, M.S. Chemical Engineering (University of New Mexico), 15 years National Laboratory (LANL). Experience: explosives, scale-up, supercritical water, hydrolysis, and process engineering.

(Explosives) Ray Flesner, Ph. D. Chemical Engineering (University of Colorado), 3 years National Laboratory (LANL). Experience: explosives, catalysis, supercritical water, scale-up, and hydrolysis.

(Microbiology) Marc Alvarez, MS. Microbiology (New Mexico State University), 3 years National Laboratory (LANL). Experience: biodegradation, analytical chemistry, enzymes, and molecular biology.

(Fermentation) John Hanners, 32 years National Laboratory (LANL). Experience: biodegradation, fermentation, amino acids, bioseparations, and cell culture.

3. Equipment and Facilities

The facilities available to perform this work will include the Fermentation and Analytical Laboratory in the Chemical Sciences and Technology Division, and the Explosives Handling Laboratory in the DX Division. These facilities contain equipment for handling explosives, culturing microorganisms and for chemical analysis. Select equipment includes: 5, 20, and 60 l fermentors, FT-IR, NMR, UV-Vis spectrometer, HPLC, GC, GC-MS, and LC-MS.