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IN REPLY
REFER TO: LS6-79-28
MAIL STOP: 495

October 3, 1979

1562 General

Mr. R. S. Lowrie, Manager
Low-Level Waste Program
Oak Ridge National Laboratory
Building 1505, Room 205
P.O. Box X
Oak Ridge, TN 37830

Dear Bob,

Attached are the revised Work Element Plans for LS-15 and LS-20, which we agreed to send to you as a result of our meeting in Albuquerque on August 24, 1979. Modifying the project description to agree with the ID work breakdown structure (LS-20 split between 3.5.4 and 3.10.1) and using the new format requested by Bob Fitts proved to be a bit more work than we expected. However, it was a useful learning exercise.

I hope the revised WEPs are what you wanted. If you have any comments, I would welcome receiving them.

Sincerely,

Jim

James G. Steger
LS-6 Alternate Group Leader
Environmental Science Group

JGS:tj

Enc: a/s

cc: Robert Lowrey, ALO

12152

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# Multiyear Work Element Plan

AL 3.5.1 JM Environmental Methods

(LS-1510A)

National Low-Level Waste Program

University of California

Los Alamos Scientific Laboratory

Life Sciences Division

Environmental Sciences Group, LS-6

Principal Investigator: J. Steger

September, 1979

Prepared for:

Department of Energy

Idaho Operations Office

Lead Field Office for Low-Level Waste Management

Under Contract W-7405-ENG-36

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## 1. Summary

The purpose of this task is to develop methods for environmental monitoring and surveillance of low-level waste disposal facilities. The approach taken will be to assess the migration of radionuclides from wastes buried during the last 35 years at LASL in order to determine waste/soil interactions and radionuclide movement in a semi-arid environment. Potentially significant pathways will be identified and modeled. A method of monitoring radionuclide movement along these pathways will be developed along with identifying the constraints that must be imposed upon disposal site operating practices and waste forms.

## 2. Introduction

Since the beginning of large-scale nuclear activities in 1943, solid low-level waste has been disposed of by shallow-land burial in controlled areas. Initially the waste volumes were quite small, but it has grown to an annual volume of about $3 \times 10^6$ $ft^3$. Some estimates indicate that this volume could grow to $40 \times 10^6$ $ft^3$/year by 2000.

Public concern and environmental regulations dictate that this large volume of potentially hazardous material must be kept out of man's biosphere as long as the wastes remain hazardous. Examination and evaluation of what has happened to long-buried wastes at DOE facilities will provide an insight into the processes, which take place after disposed, and also provide a basis for the development of predictive models to estimate the fate of buried radionuclides.

Waste has been buried at LASL for the past 35 years in a rather simple geologic media (tuff). A careful evaluations of what has taken place during this time period in a relatively simple chemical environment should increase the understanding of radionuclide migration in a semi-arid environment. This understanding will serve as the basis for the development of a monitoring system.

## 3. Goals and Objectives

The goals of this task are to achieve an understanding of the processes controlling radionuclide migration from wastes disposed of in shallow-land burial facilities in a semi-arid environment, and to develop a monitoring system to detect this migration.

The objectives of this task are to; 1) define the source term (waste quantity and disposal location), 2) describe potential release mechanisms and migration pathways (geophysical, geochemical and hydrological properties), and 3) design a method to detect radionuclide movement (monitoring system).

## 4. Sub-Tasks

a. Work Breakdown Structure (see Table I)

b. Description of Tasks.

1. Source Term Definition

Before waste/soil interactions can be defined, it is necessary to identify the initial quantities, kinds and locations of the buried waste. To accomplish this, the following activities are proposed.

1.1 Records Review

As a result of its long operating history, the records of past disposal activities at LASL exist in different forms and in different locations. Also, due to early security requirements and jargon, some of the entries in the records are vague or in a local code. Existing records are being assembled, reviewed and interpreted with the help of as many people involved in the early operations as can be located. This information will be added to the more recent records to provide as accurate a definition of the source term as possible.

1.2 Field Sampling

Samples will be taken from closed burial grounds and analyzed to determine the presence and distribution of radionuclide movement. These samples will consist of vegetation, surface soil and subsurface cores.

2. Migration Potential

Estimation of migration potential will require an understanding of the geochemical, grophysical and hydrological properties of the disposal site as well as an understanding of transport mechanisms. To accomplish this, the following activities are proposed.

2.1 Site Description

Site geological, hydrological and climatological characteristics will be investigated and defined because this information is essential input into pathway models. These properties at LASL are fairly representative of large areas in Southwestern United States.

2.2 Transport Mechanisms

Potential transport mechanisms include rain splash up onto plants, plant uptake, burrowing animals, wind erosion, soil runoff, and transport by groundwater. The primary mechanism is usually water. At LASL, there is apparently a low enough rainfall coupled with a long distance to the water table through a very dry porous media that saturated flow is considered to be extremly unlikely. Therefore, the transport mechanisms, which will receive most of the attention, are biological and unsaturated flow.

2.3 Impact Assessment

At the present time, a joint effort is underway with PNL funded by the TRU program to couple the LASL BIOTRAN (biological transport model) with the PNL ARM/SERATRA (surface runoff and

stream sediment transport model). If successful, this model will be adopted to non-TRU radionuclides as it is generic enough to represent typical arid site conditions as well as being adequate for LASL site specific needs. By adopting an existing model, considerable time and money will be saved. In addition, a project funded by ASEV at LASL is determining the characteristics of sediment transport in an intermittant stream and it is expected that this project will validate the PNL model for arid environments.

3. Action Plans

The completion of subtask 2.3 above will probably provide a basis for developing several response plans. These are:

3.1 Monitoring System

Monitoring migration in an arid environment is quite difficult. Based upon the results of 2.3 above, the most likely pathways and movement rates will be identified. With this information, a monitoring system will be designed, which not only will be compatable with the local situation, but also one that will be dynamic in that sampling requirements will be reduced as confidence in the pathway models increase.

3.2 Site Modification

If the impact assessment done in 2.3 or the DOE Disposal Criteria indicate that the existing natural barriers in the burial grounds are not adequate, engineered charges or barriers will be designed and recommended for improvements to the burial ground.

3.3 Input Waste Restrictions

Based upon the results of this task and other waste management projects at LASL, the impact of incoming waste forms will be evaluated and recommendations will be made where necessary to prohibit or modify incomming wastes to maintain the integry of the burial grounds.

Table I

Work Breakdown Structure

1. Source Term Definition
   - 1.1 Record Review
   - 1.2 Field Sampling

2. Migration Potential
   - 2.1 Site Characterization
   - 2.2 Transport Mechanisms
   - 2.3 Impact Assessment

3. Action Plans
   - 3.1 Monitoring System
   - 3.2 Site Modification
   - 3.3 Input Waste Restrictions

Table II. Milestone Schedule

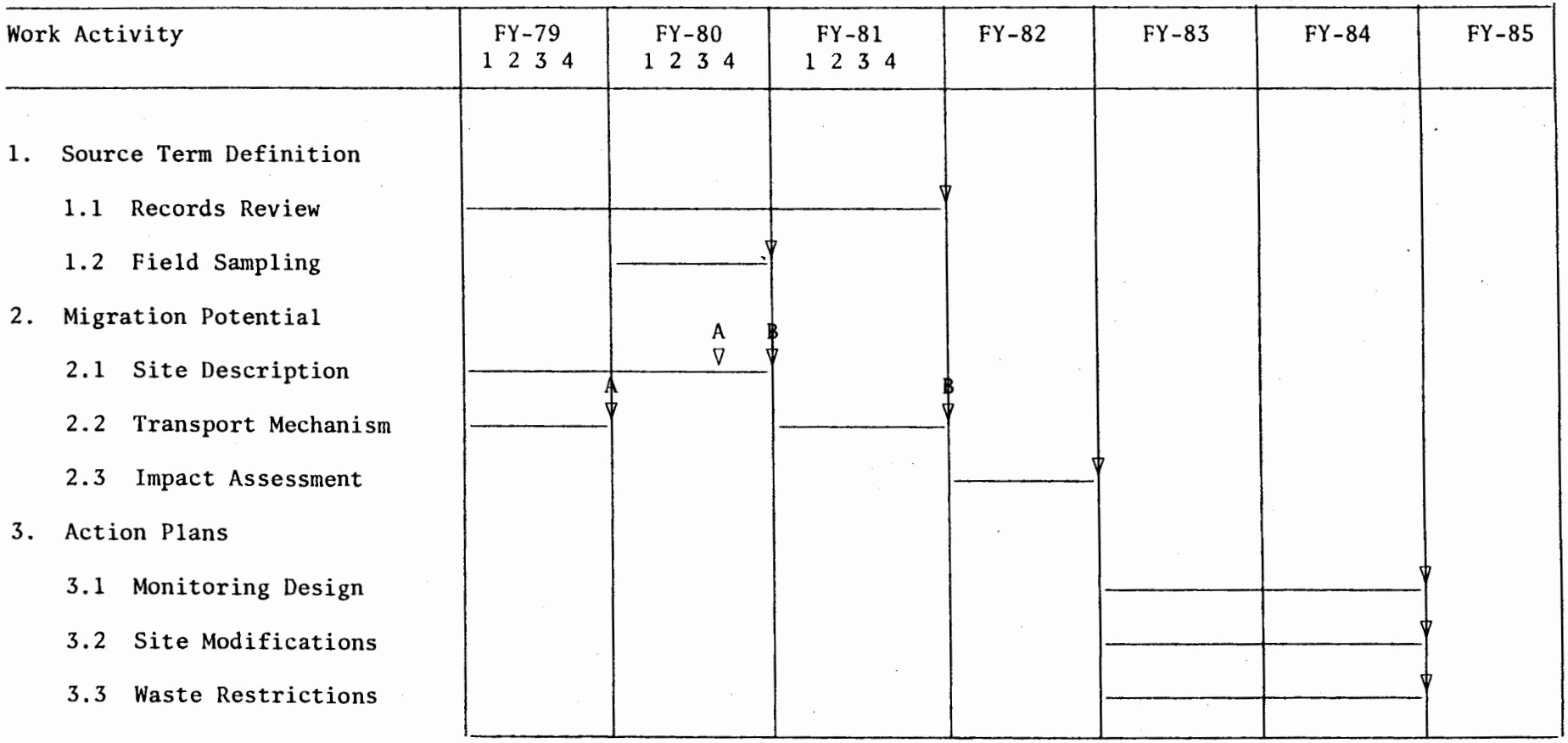

Table III

Explanation of Milestones

| Milestone Numbers | Milestone | Date |
|---|---|---|
| 1.1 | Summary Report on Source Term | 9/30/81 |
| 1.2 | Field Sampling Completed | 9/30/80 |
| 2.1A | Summary Report on Hydrologic Properties | 6/15/80 |
| 2.1B | Summary Report on Geologic Properties | 9/30/80 |
| 2.2A | Feasibility of Coupling PNL/LASL Surfac Models Determined | 9/30/79 |
| 2.2B | PNL/LASL Surface Models for TRU Adapted to LLW | 9/15/81 |
| 2.3 | Report on Methodology to Assess Impact of Burial LLW Issued | 9/30/82 |
| 3.1 | Monitoring System Plan Issued | 9/30/84 |
| 3.2 | Disposal Site Improvement Plan Issued | 9/30/84 |
| 3.3 | Waste Input Restrictions Issued | 9/30/84 |

Table IV. Program Manpower Requirements

| Research Activity | Fiscal Year (Manyears) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1979 | | 1980 | | 1981 | | 1982 | | 1983 | | 1984 | | 1985 | |
| | S | O | S | O | S | O | S | O | S | O | S | O | S | O |
| Source Term Definition | 1 | 1 | 1 | 0.5 | 0.5 | | | | | | | | | |
| Migration Potential | 0.8 | 1 | 1.5 | 1 | 2.0 | 1.5 | 2.5 | 1 | | | | | | |
| Action Plans | | | | | | | | | 1 | 1 | 1 | 1 | | |
| | 1.8 | 2 | 2.5 | 1.5 | 2.5 | 1.5 | 2.5 | 1 | 1 | 1 | 1 | 1 | | |
| | 3.8 | | 4.0 | | 4.0 | | 3.5 | | 2 | | 2 | | | |

Table V. Program Costs According to Work Breakdown Structure

| Research Activity | Fiscal Year ($,000) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
| 1. Source Term Definition | 100 | 90 | 38 | | | | |
| 2. Migration Potential | 200 | 210 | 312 | 300 | | | |
| 3. Action Plans | | | | | 200 | 150 | |
| TOTAL | 300 | 300 | 350 | 300 | 200 | 150 | 0 |

Table VI

Capital Equipment Requirements

| Work Breakdown Structure Number | Equipment Item | Cost ($,000) |
|---|---|---|
| | FY-1980 | |
| 1.2 | Drill Rig | $80 |
| | FY-1981 | |
| 1.2 | Field Survey Instrumentation | $10 |
| 2.1 | Borehole Logger | $25 |
| 2.3 | Sample Processing Equipment | $15 |

Table VII

Subcontracts

| Work Breakdown Structure Number | Purpose | Cost ($,000) |
|---|---|---|
| | FY-1979 | |
| 1.1 | Consultant, Old Records | 20 |
| 2.2 | PNL Model, Sediment Transport | 50 |
| | FY-1980 | |
| 2.1 | Geologic Map Printing | 40 |
| 2.2 | Consultant | 20 |
| | FY-1981 | |
| 2.3 | PNL Potential Pathways Models | 75 |
| 2.3 | Consultant | 20 |
| | FY-1982 | |
| 2.3 | Analytical Survices | 50 |
| | FY-1983 | |
| 3.1 | Monitoring System Design | 20 |
| 3.2 | Site Improvements Design | 40 |
| | FY-1984 | |
| 3.0 | Printing of Action Plans | 5 |

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Table VIII

# TASK REQUIREMENTS FOR OPERATING EQUIPMENT
## COSTS AND OBLIGATIONS

| CONTRACTOR NAME | | | | | |
|---|---|---|---|---|---|
| Los Alamos Scientific Laboratory | | | | | |
| BIN NUMBER | TASK NO. | REV. NO. | DATE PREPARED 9/79 | | CONTRACTOR NUMBER |

| | BY-2 | BY-1 PRESIDENT'S | BY-1 REVISED | AUTHORIZED | BY-FY 1981 |
|---|---|---|---|---|---|
| **20. STAFFING** *(in staff years)* | | | | | |
| a. SCIENTIFIC | 1.8 | | 2.5 | | 2.5 |
| b. OTHER DIRECT | 2.0 | | 1.5 | | 1.5 |
| c. TOTAL DIRECT | 3.8 | | 4.0 | | 4.0 |
| **21. OBLIGATIONS AND COSTS** *(in Thousands)* | | | | | |
| a. TOTAL COSTS | 300 | | 300 | | 350 |
| b. TOTAL OBLIGATIONS | 300 | | 300 | | 350 |
| **22. EQUIPMENT** *(in Thousands)* | | | | | |
| a. EQUIPMENT COSTS | | | 80 | | 50 |
| b. EQUIPMENT OBLIGATIONS | | | 80 | | 50 |
| **23. OTHER COSTS** *(specify)* | | | | | |
| a. | | | | | |
| b. | | | | | |
| c. | | | | | |
| d. | | | | | |

| **24. OPTIONAL FIVE-YEAR PLAN** *(in Thousands)* Constant BY dollars | BY +1 | BY +2 | BY +3 | BY +4 |
|---|---|---|---|---|
| a. TOTAL OPERATING COSTS | 300 | 200 | 150 | 0 |
| b. TOTAL OPERATING OBLIGATIONS | 300 | 200 | 150 | 0 |
| c. TOTAL EQUIPMENT COSTS | | | | |
| d. TOTAL EQUIPMENT OBLIGATIONS | | | | |

| **25. MILESTONE SCHEDULE** | PROPOSED SCHEDULE | AUTHORIZED SCHEDULE |
|---|---|---|
| | | |

ZBB Impact Statement

Minimum Level

At the minimum level, the supporting subcontracts with a consultant and PNL will be deferred one year. This will result in the pathway modeling of radionuclide migration being delayed one year and not having some data available that will be required by LASL TRU Waste EIS until one year later than required.

Current Level

AT the current level, the consultant on pathway analysis will not be employed resulting in possible weaknesses in the PNL modeling effort. Quality will be sacrificed, but there should be no delay in milestones.

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# TASK REQUIREMENTS FOR OPERATING/EQUIPMENT COSTS AND OBLIGATIONS

CONTRACTOR NAME: Los Alamos Scientific Laboratory

| BIN NUMBER | TASK NO. | REV. NO. | DATE PREPARED | CONTRACTOR NUMBER |
|---|---|---|---|---|
| | | | 9/79 | |

| 20. STAFFING (in staff years) | BY-2 | BY-1 BY 1980 | | BY FY 1981 | | |
|---|---|---|---|---|---|---|
| | FY 1979 | PRESIDENT'S | REVISED | Minimum | Current | Enhanced |
| a. SCIENTIFIC | 1.8 | | 2.5 | 2.5 | 2.5 | 2.5 |
| b. OTHER DIRECT | 2.0 | | 1.5 | 1.5 | 1.5 | 1.5 |
| c. TOTAL DIRECT | 3.8 | | 4.0 | 4.0 | 4.0 | 4.0 |
| 21. OBLIGATIONS AND COSTS (in Thousands) | | | | | | |
| a. TOTAL COSTS | 300 | | 300 | 255 | 330 | 350 |
| b. TOTAL OBLIGATIONS | 300 | | 300 | 255 | 330 | 350 |
| 22. EQUIPMENT (in Thousands) | | | | | | |
| a. EQUIPMENT COSTS | | | 80 | 50 | 50 | 50 |
| b. EQUIPMENT OBLIGATIONS | | | 80 | 50 | 50 | 50 |
| 23. OTHER COSTS (specify) | | | | | | |
| a. | | | | | | |
| b. | | | | | | |
| c. | | | | | | |
| d. | | | | | | |

| 24. OPTIONAL FIVE-YEAR PLAN (in Thousands) Constant BY dollars | BY +1 | BY +2 | BY +3 | BY +4 |
|---|---|---|---|---|
| a. TOTAL OPERATING COSTS | 300 | 200 | 150 | 0 |
| b. TOTAL OPERATING OBLIGATIONS | 300 | 200 | 150 | 0 |
| c. TOTAL EQUIPMENT COSTS | | | | |
| d. TOTAL EQUIPMENT OBLIGATIONS | | | | |

| 25 MILESTONE SCHEDULE | PROPOSED SCHEDULE | AUTHORIZED SCHEDUL |
|---|---|---|
| | | |

Table X. Milestone Schedule (ZBB)

| Work Activity | FY-79 1 2 3 4 | FY-80 1 2 3 4 | FY-81 1 2 3 4 | FY-82 | FY-83 | FY-84 | FY-85 |
|---|---|---|---|---|---|---|---|
| 1. Source Term Definition | | | | | | | |
| 1.1 Records Review | | | | | | | |
| 1.2 Field Sampling | | | | | | | |
| 2. Migration Potential | | | | | | | |
| 2.1 Site Description | | A | B | | | | |
| 2.2 Transport Mechanism | | | | B | B M | | |
| 2.3 Impact Assessment | | | | | | | M |
| 3. Action Plans | | | | | | | |
| 3.1 Monitoring Design | | | | | | | |
| 3.2 Site Modifications | | | | | | | |
| 3.3 Waste Restrictions | | | | | | | |